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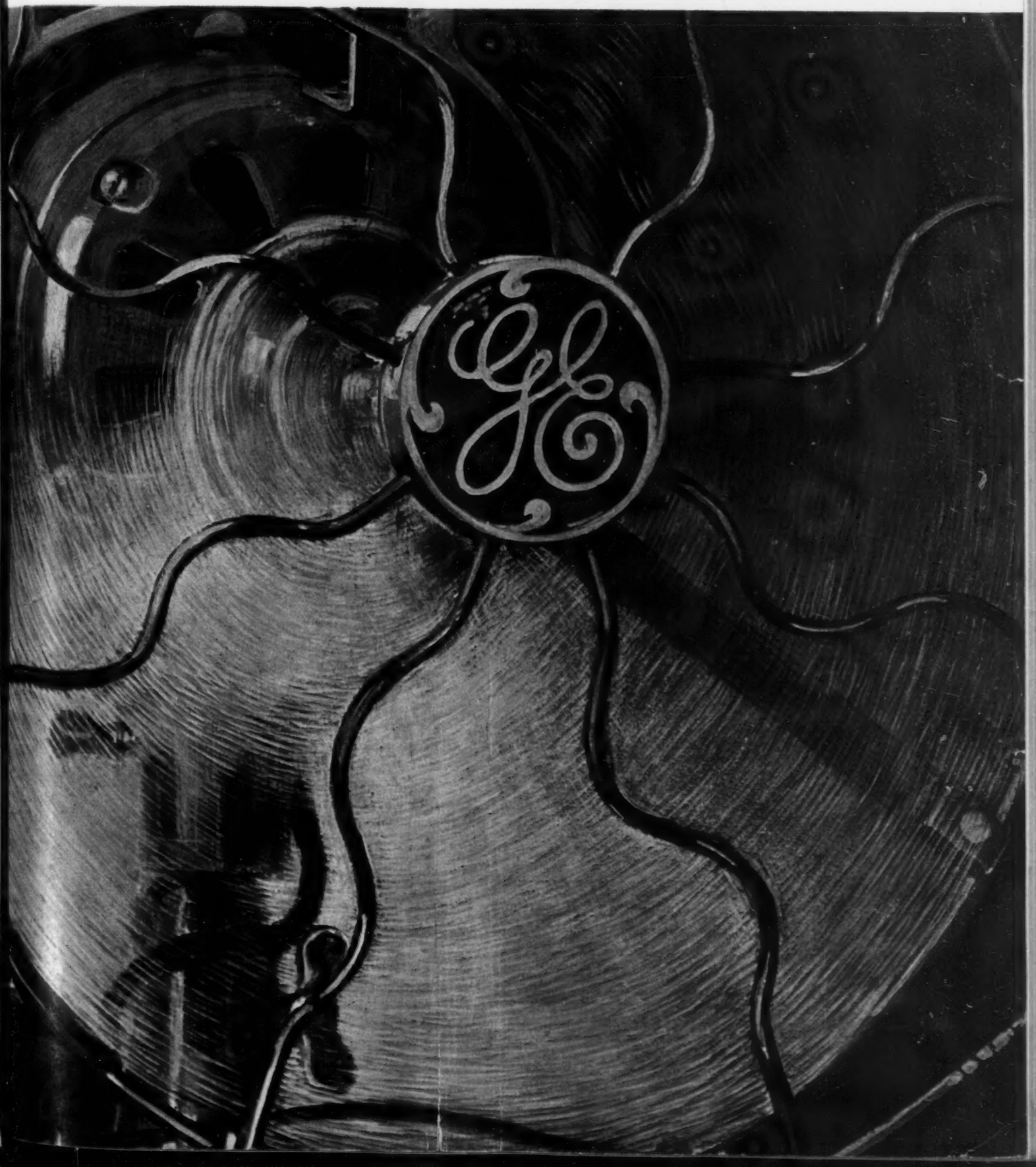

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Electrical World

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The Trend Toward Interconnection

WE SOMETIMES wonder whether public utility operators are alive to the situation regarding the interconnection of contiguous systems and the desire in some quarters to have the government undertake such work. There can be no question of the economy of interconnection and of the numerous other benefits accruing to users and utilities alike. For that reason it would be a calamity to have the government undertake the work owing to the disinclination of public utility companies to act. Thus far the initiative for interconnection has come from the industry itself, and there are a sufficient number of interconnected generating systems now in existence to prove or disprove the economic and operating advantages inherent in such a scheme. The electric lighting industry must face the fact that interconnection will take place and that if it does not grasp the opportunity some other agency will. It is for the best interests of all concerned that the electrical industry itself undertake this work, for, to quote Theodore N. Vail: "Initiation is the province of operation. Initiation must come from familiarity, continuous intimate association with and observation of operation. Initiative must be controlled by judgment that comes only from experience. Uncontrolled initiative has created havoc with many enterprises." This is the ripe judgment of a man presiding over the greatest interconnected communicating system in the world. Is it wise for the industry to wait until the government acts?

Oh, for a Moses to lead us out of the wilderness of industrial strife! Apparently we need a peace conference of employers and employees as badly as we need a peace conference of nations. We need also more action and less talking.

Preparing for New Water-Power Legislation

ONE redeeming feature of all of the discussion which the various water-power bills of the past seven years have brought forth is that it has served to clarify the situation. Little if anything new can be contributed to the subject of water-power utilization, so that quick action is to be expected in the next Congress. For ourselves, we could wish for nothing better than the reintroduction of the so-called administration bill reported by the conference committee of the House and Senate. While not perfection, the bill is as good a one as can be expected. Long debate has served to polish the measure so that it stands out like a diamond. It has some flaws, but they do not detract greatly from its sparkle. Life is too short to start again from the beginning on water-power legislation. Those interested in developing the country's natural resources cannot do better than benefit from what has already been done and start where the last Congress left off.

Some knowledge of administrative and commercial training is as essential to the professional engineer as technical knowledge. Unless an engineer learn somewhat of the first two without sacrificing the last, he must be content to fill a minor rôle in life.

Why Are They for Government Operation?

WE ARE lumbering along from day to day without a concrete national policy on vital railroad, telegraph and telephone systems. Why do those who favor permanent government operation of these properties argue against a return of them to their owners? As a matter of fact, extraordinarily little real argument is heard from any individuals in prominent position in support of a permanent extension of government operation in this direction. Under these conditions, so difficult to define, is it worth while to question whether a large issue of government policy is in the balance? Or is it more in the public interest or the interest of our industry to assume that we are still a long way from the bridge and crossing? We think that it is clearly in the public interest that this country shall not embark on a national policy of government operation unless and until it shall have first satisfied itself that that is the wisest and best economic course. We certainly maintain that it is not in the interest of the country to stumble slipshod to a revolutionary change without thought or study or clear knowledge of what is being done. In short, it is, in our opinion, a time when something may be gained by plain public discussion of the sequence of events at Washington, of their possible meaning, and of the principles which are at stake.

Among the reasons which might be advanced by the advocates of public ownership or operation are: Breakdown of service, excessive cost of property or operation under private direction, and financial jugglery involving inexcusable loss to investors or unwarranted cost of service to the public. Another class of reasons may be described briefly as desire for a centralized power or for socialization of the republic. Reviewing the conditions which preceded the action of the federal government in taking control of railroads as a war measure, it is evident that these utilities were strained to the breaking point. Yet the government did not try to provide them with the sweeping authority to correct part of the underlying responsible conditions which it used unhesitatingly itself as soon as it had the operation of the carriers on its own hands. It did not give

permission to the privately operated carriers to meet rising cost of operation by unprecedented rate increases, but it made such rate increases together with enormous advances in wages when it became the responsible operator of the properties. Some one was responsible for the bad plight of railroads before they were taken over by the government. The companies were if they held back needed development and effort simply to force the government to act; the government was responsible if by its policy of declining fair rates it deliberately drove the carriers into a position where financing was impossible. What is needed is an economic inquiry into the railroad situation. Upon the present showing of facts it would be utterly senseless for even the most fervent proponent of government operation to urge a continuation of that form of control on the ground that it would mean rates lower than those attainable under private operation.

We believe that the days of financial jugglery in the regulated utilities are past. If there is any possibility that those days are not gone forever it will certainly be to the interest of the entire public that legislation shall be enacted to make the assurance positive. But there is similarity in kind if not in degree between rampant financial jugglery by private operators and possible misuse of funds by operators representing the public. It should not be forgotten that there is danger of abuse of the railroad capital investment and the railroad operating expense account under public operation too. To pay railroad employees unduly large salaries or wages at the expense of rates is an offense which can exist under public as easily as under private direction.

If the gentlemen who seek public operation or ownership have only a worthy ambition to promote the public welfare, is it still desirable that they should be encouraged to believe that this policy will be to the advantage of the nation? Should so powerful an instrument for political domination be put into the hands of any party as would follow nationalization of the interstate carriers and communication utilities? We do not attribute selfish motives to any one, but we hold that the great economic and social considerations should be given due weight before the country thinks of turning from a war-time expedient to new and untried platforms. Power distributed among many can be controlled through regulation. Power concentrated in a few who may keep the reins of government carries a possibility of self-perpetuation that is disquieting. We have progressed to eminence as a republic. To abandon the time-honored principles and to change without carefully weighing the factors involved is the course of peril.

One of the lessons war has taught is that an electrical association can have a good convention without providing great quantities of expensive entertainment for the delegates. Entertainment at conventions there will always be, of course, but at many meetings hereafter it will be of a different sort.

Industry Waiting on Water Power

THE present ubiquitous Ford car is to be outdone if Henry and his son Edsell succeed in circumventing the Dodges and finding suitable locations for their factories. Just now their chief concern is to determine on sites for their various works. That they are having some difficulty in this matter is evidenced by a statement of Edsell Ford. "We expect to start work on our plants in the early part of next year," he said. "We are hunting water power and so far have only two definite locations, and they were bought primarily for tractor factories. They are at Hamilton, Ohio, and Troy, N. Y." Here is tangible evidence of a case where a man with ability and ample funds runs against the brick wall of federal inaction regarding the nation's water powers. Thus not only are waiting thousands disappointed by the deferred advent of the cheaper automobile, but the new towns which usually spring up around factories of this sort must remain on paper a while longer.

On general principles, the end of a transmission system is the proper point for paralleling duplicate lines, since it simplifies the switching apparatus and cushions, so to speak, the whole system. It also permits a spare generator to be used for voltage regulation.

Military Radio Communication

ONE of the vital conditions characterizing the existence of an army is that all of its elements shall be constantly within administrative communication of its commander, both for the reporting of events to headquarters and for the reception of orders from headquarters to any or all units. The duty of maintaining this intercommunication in the American army devolves upon the Signal Corps. The methods employed are various and manifold. They include electric telegraphy and telephony by wires, semaphores, heliographs, visual signaling, rockets, flares, runners, pigeons, cyclists, mounted messengers, acoustic signaling, ground telegraphy and finally, in this war, radio-telegraphy and radio-telephony.

The importance of radio communication and measurements in the Signal Corps service of the American Expeditionary Forces is well described in our article this week by Capt. A. D. Cameron. It was doubtless of similar importance in all the allied armies. The enemy also used it very extensively. It is a foregone conclusion from what Captain Cameron describes that no army of a first-rate power in the world can dare to neglect the development and maintenance of military radio-communication methods, apparatus and training during times of peace. Even on the assumption, however fond and illusory it may be, that war shall be no more, the mere police duty of the allied armies, all over the world, for the keeping of the world's peace and the incipient nipping of war buds, will call for a proper and regulated development of army radio communication.

Although the article of this week is devoted, in the main, to radio and radio communication, it should be remembered that the installation, maintenance and operation of the entire communication system of the American Expeditionary Forces, from the submarine cable termini in Europe, through the numerous French bases, depots and headquarters, out to the most remote airplanes in radio touch with their supports, devolved on the Signal Corps. The officers and men of that corps won widespread approval from the army and deserve unstinted praise for the way in which their work was done. They were called upon to plan and install, under many handicaps in material, a large telegraph and telephone system in France, and to some extent also in England and in Italy. They carried on communication

with American operators, methods and apparatus, often under conditions that would be regarded as hopelessly impossible from peace-time standpoints. Although rated as non-combatant troops, they had to advance with the infantry and field artillery, pushing forward and maintaining the network of communication, repairing wires under shell fire, and holding untenable positions. They operated in every place that the infantry occupied, from buildings and billets, to dug-outs, huts, trenches, shell holes and the open fields, in all weathers and conditions of support. Captain Cameron's article indicates how much interest, both historical and human, might attach to a book written on the service of the Signal Corps with the A. E. F., giving not only such technical and historical information as is proper but also an accurate presentation of the service conditions.

From Sir John Jellicoe's book it is apparent that engineering and technical matters were treated much more successfully by the German navy than by the English. The searchlight equipment of the latter seems to have been scandalously deficient, but whether this is a criticism of English electrical engineers or of the British Navy is not indicated. The thing that is apparent is that the British naval officials did not utilize the skill of the electrical engineer.

Some Specific Problems of Industrial Lighting

WE HAVE preached so many times upon the text of good lighting as an aid to efficiency that general propaganda would seem to be almost superfluous. In the current issue Professor Clewell gives some details of the lighting of two large industrial plants which are peculiarly valuable, inasmuch as they deal not with the general situation but with some of the special problems which have to be met. One of these cases is a set of large new buildings for a munition plant. Their form is not unusual, the space being divided by concrete columns into three bays 20 ft. (6 m.) wide with a 10-ft. (3-m.) aisle extending down the center of each shop. Throughout the entire space the outlets are on 9-ft. by 10-ft. (2.7-m. by 3-m.) centers, each provided with a 100-watt gas-filled lamp in a steel-enameled dome. For most of the work this proved quite sufficient, as will usually be the case where the power expended per square foot is high, as it was in this case. For some operations, especially the running of lathes, screw machines and drill presses, this general lighting was not adequate in following the action of the tool and setting the index graduations on the machines. Therefore 40-watt individual lamps properly shaded have been installed to meet this particular requirement. As a rule, the new plants erected for war industries have been pretty well lighted, although contrary instances are unfortunately to be found, due perhaps partly to carelessness and partly to the difficulty of getting suitable lighting equipment on short notice.

In closing, Professor Clewell lays stress on the very important point that all lamps on drop cords should be fitted with reflectors, and the same rule applies with equal force to the case of any individual lamp, which should not only be fitted with a suitable reflector to keep the glare out of the eyes of the workman but should also be adjustable so that lamp and reflector can be brought into the most effective position for illumination of the work.

The Oil Engine and Electrical Supply

OF THE many things which have varied in cost with most startling rapidity during the war, none has been more conspicuous than fuel. Fuel of every kind has shot up in expense to forbidding figures. The price of coal has been enormously increased by added charges for labor and transportation and by scarcity of both, and it is not likely to decline rapidly, for the price of labor must keep pace with the cost of living and neither shows any very hopeful signs of retreat. They are at a deadlock, neither wishing to be the first to climb down, so that fuel costs are likely to remain high for some time, producing in the case of electrical supply stations a necessary added charge which has been many times recognized in the rates permitted to the utility companies.

A brief paper in our columns this week directs attention to the effect of the cost of coal and the need of conservation and brings out especially the possible importance of the oil engine as an economic remedy, not for the general case of power generation perhaps, but for certain important special cases which in the aggregate hold a large place. At the present time fuel oil has, of course, been considerably affected in price, but in the long run it is likely to decline more than coal, for the simple reason that labor and transportation are less serious in its case than in the case of a fuel which has to be mined and carried in cars. Oil is obtained at very moderate production costs so far as labor is concerned, and much of its transportation is via pipe lines. The oil engine, as our correspondent points out, is from a thermo-dynamic standpoint extremely efficient, something like twice as efficient as a steam generating equipment of moderate output.

The oil engine has been used only to a moderate extent in this country thus far, chiefly because many of the American machines were designed to be built cheaply and not for the highest possible efficiency, and also because, inasmuch as they are relatively simple, they have not always received their fair share of skilled attendance. At the present time the tendency in design is toward highly efficient units even if of considerably greater cost than the earlier types. In the long run the gain in fuel efficiency considerably more than offsets the first-cost charges, with the added advantage of being better able to cope with rising costs of oil, if they should come in the future, and thus reducing on the whole the relative costs of operation.

Where electric supply can be obtained from large and well-planned power stations driven either by waterwheels or steam turbines electric power can be obtained under ordinary circumstances at a figure which leaves little room for economy in independent plants driven either by steam or oil engines. There are many cases, however, where it is desirable to have power in considerable amounts at points remote from a convenient or economical source of electrical supply or where the conditions of demand are such as to make it difficult to obtain low enough rates from existing plants. In such instances generating equipment driven by oil engines is well worth very serious consideration, since the cost of operation, including all items, can be brought to a figure in most cases below that attainable by coal in similar situations. At all events the subject is one which deserves careful investigation on the part of engineers, particularly in view of the likelihood that the price of coal will for a considerable period of time remain at a high level.

Field Testing of Instrument Transformers

Experiences with the Agnew Method Show It to Be Very Valuable for Tests Conducted at Place of Installation—Simplifications in Calculations and Amount of Equipment Used

BY H. M. CROTHERS
University of Wisconsin

THE method* of comparing instrument transformers with a standard transformer of known characteristics has proved so valuable in field testing and for small laboratory work that the results of the author's experiences with it may be of value to other engineers. To make clear the discussion which will be presented a brief review of the theory of the Agnew method will first be given.

For comparison of current transformers the standard and the test transformers have their primary windings connected in series in the supply circuit as shown in Fig. 1. The secondaries are connected to the current coils of two portable standard watt-hour meters, and a four-pole switch is interposed for the purpose of switching the meters from one transformer to the other. The voltage coils are connected either in series or parallel according to the voltage available and are controlled by a common snap switch.

For comparison of the current ratio of the transformers the voltage supplied to the potential coils should be in phase with the current through the current coils. Under these conditions the phase-angle shift between the primary and secondary currents in the transformers has no appreciable effect on the registrations of the meters.

With a chosen primary current flowing the ratio between the readings of the meters, if started and stopped together, will depend on their own adjustments and upon the current ratios of the transformers through which they are supplied, or

$$A_s/B_x = (R_xK_a)/(R_sK_b) \qquad (1)$$

in which R_s = the current ratio of the standard transformer: R_x = the current ratio of the test transformer; K_a = a constant depending upon the adjustment of meter A; K_b = a constant depending upon the adjustment of meter B; A_s = registration of meter A connected through standard transformer, and B_x = registration of meter B connected through test transformer. If the meters be interchanged in the transformer secondaries and another pair of readings taken with the same current, then

$$A_x/B_s = (R_sK_a)/R_xK_b \qquad (2)$$

or dividing the equations member by member eliminates the meter constants and gives

$$(A_sB_s)/(A_xB_x) = (R_x/R_s)^2,$$

$$\text{or } R_x/R_s = \sqrt{(A_sB_s)/(A_xB_x)} \qquad (3)$$

Agnew shows that this equation may be put in the form

$$(R_x - R_s)/R_s = \tfrac{1}{2}[(A_s - A_x)/A_x + (B_s - B_x)/B_x] \qquad (4)$$

To determine the difference between phase angles of the two transformers it is necessary to operate the meters at a low power factor. The registrations, then, are affected both by the current ratio and by the phase shifts of the secondary currents. If the voltage be shifted by the angle θ (measured positive when the voltage leads the current) and another set of readings (A'_s, B'_x, A'_x, B'_s) is taken, then the angle α_x, by which the secondary current leads the reversed primary current according to Agnew is

$$\alpha_x \text{ (in minutes)} = \alpha_s - 3438/\tan\theta\,[(A'_s - A'_x)/2\,A'_x + (B'_s - B'_x)/2\,B'_x - (R_x - R_s)/R_s)]$$

This is equivalent to the form given below in the discussion.

SIMPLIFIED CALCULATIONS

Use of this method in testing a large number of transformers has led to the development of simpler forms of the equations given. For the calculation of the current ratio of the test transformer a form is used which may be obtained from equation (3) by use of two simple expedients.

The first and most obvious step is, when taking the readings, to make $A_s = A_x$ and equal to some integral number of revolutions. Doing this, equation 3 becomes

$$R_x/R_s = \sqrt{B_s/B_x} = \sqrt{1 + (B_s - B_x)/B_x}$$

Expanding by the binomial theorem, all terms after the second may be dropped with a resulting error of the order of 0.01 per cent. This gives

$$R_x/R_s = 1 + \tfrac{1}{2}[(B_s - B_x)/B_x] \text{ or}$$

$$(R_s - R_x)/R_s = \tfrac{1}{2}\,[(B_s - B_x)/B_x] \qquad (5)$$

The same form is obtained immediately from equation (4) when $A_x = A_s$.

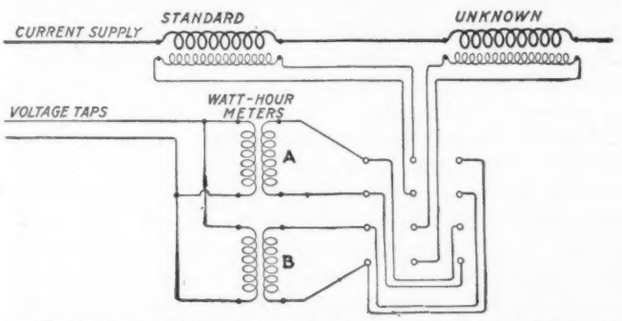


FIG. 1—CONNECTION OF APPARATUS USED BY AGNEW IN TESTING CURRENT TRANSFORMERS

The second expedient is the use of the "ratio factors" F_s and F_x instead of the ratios. As used by the Bureau of Standards, this term is defined as the true ratio divided by the marked ratio. It is convenient to state the ratio factor in per cent

$$F_s \text{ (in per cent)} = 100\ R_s/R_m \text{ (marked ratio)}.$$

The use of ratio factor is found helpful not only in this case but in all work with instrument transformers. Meters connected through instrument transformers usually have their scales or dials numbered to take account of the marked ratio of transformations so that if the ratio factor is stated in per cent the percentage error in the readings due to transformers is at once apparent.

*Described by P. G. Agnew of the Bureau of Standards in the Nov. 21, 1914, issue of the ELECTRICAL WORLD.

The ratio factors are obtained by multiplying the numerator and denominator of the left member of equation (5) by $100/R_m$, giving

$$(F_x - F_s)/F_s = \tfrac{1}{2}\,[(B_s - B_x)/B_x],$$
$$\text{or } F_x = F_s + F_s\,[(B_s - B_x)/2\,B_x] \qquad (6)$$

The second term of the right member of equation (6) is of the order of 1 per cent of the first term. Therefore a few approximations in the second term will not affect appreciably the final result of the calculations. For F_s the value 100 may be substituted since the ratio factor of the standard transformer is always very close to 100 per cent. Again for B_x the value A_s, which is very nearly equal to it, may be substituted. A_s is an even number and makes the arithmetic easier. Finally,

$$F_x = F_s + 100\,[(B_s - B_x)/2A_s] \qquad (7)$$

(F_s and F_x are stated in per cent.) ($A_s = A_x$).

The error in the value obtained for F_x due to all approximations involved will not exceed 0.1 per cent when the difference between the two transformer ratios is not over 3 per cent and the difference between the meter rates is under the same limit.

To calculate the phase angle α_x the following line of reasoning may be used: It may be seen from equation (7) that $100\,[(B_s - B_x)/2A_s]$ gives the percentage difference in the ratio factors of the transformers. The only new element affecting the second set of readings taken at low power factor is the fact that the secondary currents are displaced by different angles from the primary current, and therefore the power factor at which a meter operates depends on the transformer through which it is connected. The difference then between $100\,[(B'_s - B'_x)/2A'_s]$ and $100\,[(B_s - B_x)/2A_s]$ will give the percentage difference in the power factors $\cos(\theta - \alpha_x)$ and $\cos(\theta - \alpha_s)$,

$$\text{or } 100\,[\cos(\theta - \alpha_s) - \cos(\theta - \alpha_x)]/[\cos(\theta - \alpha_s)]$$
$$= \pm 100\,[(B'_s - B'_x)/2A'_s - (B_s - B_x)/2A_s] \qquad (8)$$

The left member reduces approximately to $(\alpha_x - \alpha_s)\tan\theta/34.38$, so

$$\alpha_x = \alpha_s \pm (34.28/\tan\theta)\,[100(B'_s - B'_x)/2A'_s - 100\,(B_s - B_x)/2A_s]$$

When a three-phase supply is used, θ is usually 60 deg., so

$$\alpha_x = \alpha_s \pm 20\,[100\,(B'_s - B'_x)/2A'_s - 100(B_s - B_x)/2A_s] \qquad (\theta = 60) \qquad (10)$$

The sign of the bracketed expression is determined by the definition of α and θ and by the kind of transformers under test. With α defined as the small angle by which the secondary current (or voltage) leads the reversed primary current (or voltage) and θ defined as the angle by which the supplied voltage leads the supplied current, equation (9) becomes for current transformers,

$$\alpha_x = \alpha_s - (34.38/\tan\theta)\,[100\,(B'_s - B'_x)/2A'_s - 100\,(B_s - B_x)/2A_s] \qquad (11)$$

For voltage transformers

$$\alpha_x = \alpha_s + (34.38/\tan\theta)\,[100\,(B'_s - B'_x)/2A'_s - 100(B_s - B_x)/2A_s] \qquad (12)$$

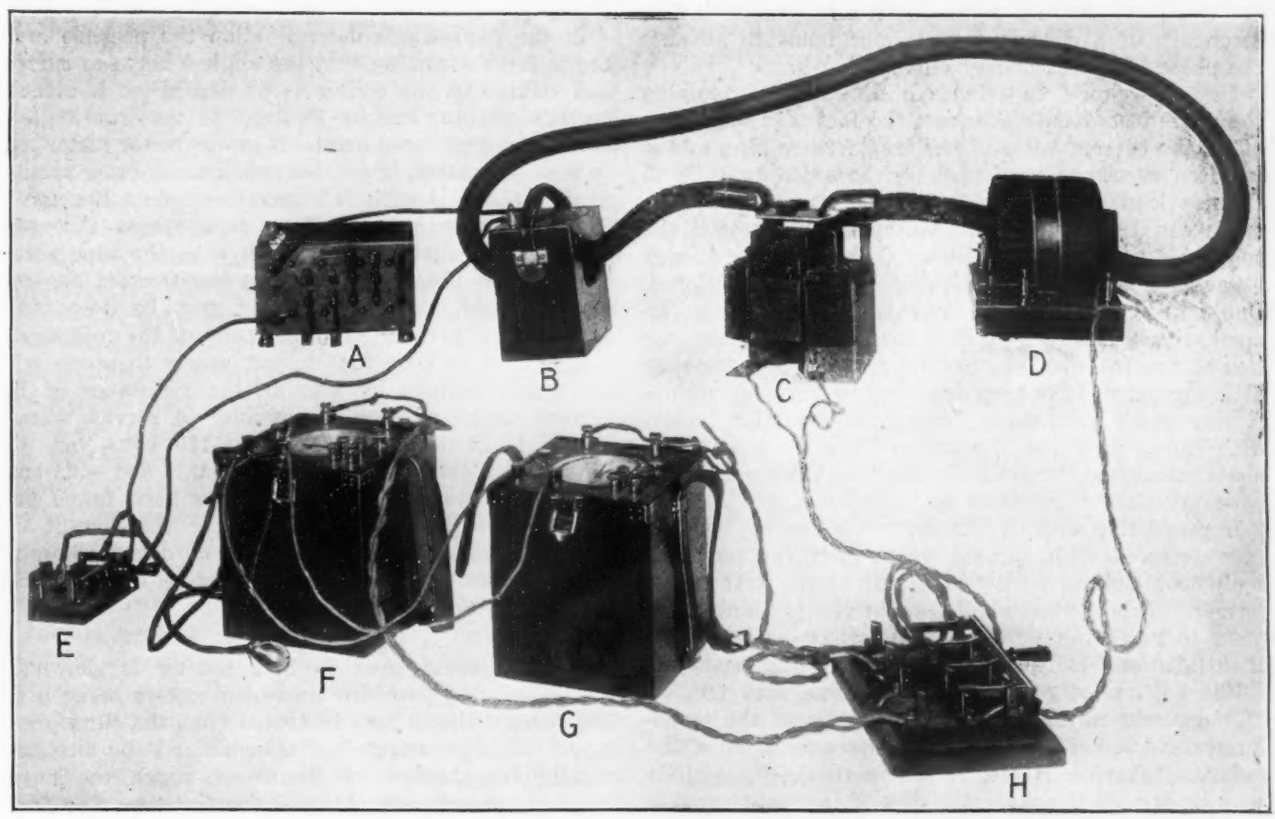


FIG. 2—ACTUAL APPARATUS USED IN CONDUCTING CURRENT TRANSFORMER TEST

A—Control rheostat. B—Auxiliary transformer. C—Test transformer. D—Standard transformer. E—Three-phase supply switch. F—Meter A. G—Meter B. H—Four-pole double-throw switch.

Example.—To illustrate the computation which must be made a numerical example will be presented for a given current transformer.

Let $F_s = 99.4$ per cent; $\alpha_s = 30$ min.; $\theta = 60$ deg.;

$A_s = 10.00$,	$A_s' = 5.00$,
$B_x = 9.88$,	$B_x' = 5.04$,
$A_x = 10.00$,	$A_x' = 5.00$,
$B_s = 10.04$,	$B_s' = 4.97$.

From equation (7)

F_x = 99.4 per cent + (1004 — 988)/20 per cent = 99.4 per cent + 0.8 per cent = 100.2 per cent.

From equation (11)

α_x = 30 min. — 20 [(497 — 504)/10 — 0.8] min. = 30 min. + 30 min. = 60 min.

The use of equations (7) and (11) or (12) has been found to reduce greatly the work of calculation and to eliminate even the necessity of using the slide rule in most cases.

To Determine Whether θ Is Positive or Negative.—By connecting the voltage coil of a watt-hour meter to one phase of a three-phase circuit and supplying the current coil from another, the meter (if the direction of rotation is forward) will be operating at a power factor of 50 per cent, but the voltage may be either lagging or leading. It is necessary to determine which is the case in order to fix the signs of equation (11) or (12).

Agnew, in the original paper, pointed out that it is possible to determine whether the test transformer has the greater or the smaller phase angle from the following facts: "(1) Adding non-inductive load to a voltage transformer always tends to lag the secondary voltage. (2) Adding non-inductive resistance in the secondary of a current transformer tends to advance the phase of the secondary current."

In the writer's experience a difficulty in applying the above tests has arisen from the fact that such loads affect the current ratio of the transformer also, and it is often necessary to determine the ratio again with the new load before the effect of the load on the phase angle can be definitely known. For this reason the suggested method has not been depended upon to any great extent, and other methods have been developed. One method used involved the carrying of extra equipment with which to determine the order of phase rotation at any installation. Several plans calling for very little equipment have been described by various authors. A very small home-made three-phase induction motor, with known direction of rotation for a given order of phase rotation at its terminals, has been the usual choice, however, since ruggedness and quickness are desired.

In connection with the Agnew test a new method has been followed with success which calls for no extra equipment and no extra test except at the first transformer. This method applies when one is going from place to place testing each transformer at the place of installation. It depends upon the following relations:

When $A'_s = A'_x$ equation (11) shows that $(B'_s - B'_x)$ depends only on the characteristics of the transformer and is independent of the characteristics of the meters. Likewise it can be shown that $(B'_s + B'_r)$ depends only on the characteristics of the meters and is independent of the characteristics of the transformers. These relations can be utilized as follows: In the laboratory, or in some installation where the order of phase rotation is known, let a set of readings be taken at some chosen current through the meters and with $\theta = +60$ deg. Suppose $B'_s + B'_r = N'$. Take another set of readings with the same values for the A readings and with $\theta = -60$ deg. If there is a small difference in the phasing adjustments of the two meters, the sum of the B'' readings will be different from N', say $B''_s + B''_x = N''$. On the subsequent tests at other places shift the voltage taps at random and take the readings for the phase-angle determination. At the current previously chosen again make the A readings the same as used before, and if the sum of the B readings is equal to N', the angle is positive. If the sum is equal to N'', the angle is negative.

Effect of Inductance in the Current Circuits.—In the preceding discussion it has been assumed that the currents in the transformers and meters are in phase with the voltage to which they are connected. Experience shows that this is sometimes far from being the case. Instances have been met in which the current lagged 30 deg. or more. It is necessary to be always on guard against this possibility, for neglect to do so may lead to large errors.

It will be recalled that in determining the ratio of the transformer it was assumed that the meters were operating at a high power factor so that the effect of the transformer phase angles would be negligible. However, the effects of the phase angles are not negligible, generally, if the meters are operating at a power factor of 0.96 or lower. This corresponds to a lag of the current behind the voltage of 15 deg. or more. If the angle is 15 deg., equation (7) may be applied with a possible error due to this cause as high as 0.2 per cent; it will be less than 0.1 per cent if the phase angles of the two transformers differ by 30 min. or less.

In the phase-angle determination the possible error comes from assuming that the angle θ between current and voltage on the meters is 60 deg. when it actually may be more or less by 15 deg. If the true angle is known, no error need arise. A power-factor meter may be used, of course, if one is available. Another method used in the field with fair success involves timing the meters first with the voltage taps across the same phase as the current leads, then with the taps across the adjacent phase. If the watt-hour meters are correctly phased, the power factor may be determined within a few per cent from the ratio of the readings.

It is best to keep the current nearly in phase with the supply voltage by keeping the resistance of the current circuit as high as possible. A service voltage of 220 is better, therefore, than 110 volts, but 440 volts is still better if suitable rheostats and watt-hour meters are available. It has always been found possible to keep the phase angle between the current and voltage within the 15-deg. limit of 60 deg. by keeping the resistance of the control rheostat up to at least 20 ohms.

FIELD TESTING

The equipment used in field testing is shown in Fig. 2, rotating standard watt-hour meters being used. The current circuit may be traced from the three-phase supply through the control rheostat and the auxiliary current transformer by means of which the heavy primary currents are obtained for testing. The four-pole switch in the secondary circuits for interchanging the meters is preferred to two single-pole switches, because there is less chance for errors in switching which might result in a short circuit on the secondaries of voltage transformers or in an open circuit in the secondaries of current transformers.

The Agnew method of testing instrument transformers has proved of great value in conducting tests on both current and voltage transformers at the places of installation and under conditions in which no other test would have been feasible. In one mining district sufficient equipment was carried around in a light buggy to test current transformers rated as high as 800 primary amperes. Even with the bad voltage regulation which existed, no difficulty was experienced in

checking results, and the work demonstrated that the method is exceptionally good for field testing practically as well as theoretically.

It is possible to adapt this method of test to the absolute calibration of the standard current transformer which is used in checking the others. This adaptation enables any small laboratory to test current transformers without depending on outside assistance for even the calibration of the standard. It will be described in a later paper.

Place for Oil-Engine-Driven Generators

Attendance and Grade of Oil Required—Operating and Maintenance Expenses—Efficiency Compared with Other Prime Movers—Analysis of Expenses with Old and New Types of Engines

THE European war has forced a great and rapid change in our whole economic structure. Perhaps most marked of all these changes is the national realization of the limitations of fuel supplies. This was emphatically brought out during the war by the serious curtailment in some instances of both coal and oil fuels through government regulations. These regulations are now largely removed. However, the nation has been forced to realize the importance of fuel conservation. With this realization comes hand in hand the demand for maximum returns from such fuel as is used. The extravagant waste of coal under many thousands of small boilers has already received some attention. Probably the most important step in conserving fuel has been the interlocking of electric power systems. Remarkable results have been obtained and still further improvements from a fuel conservation or utilization standpoint may be expected.

However, there are conditions under which it is not practicable to tie in with large electric service systems, such as in a small town not near a transmission system, and here a small plant is necessary. When operated by steam the small power plant has an inherently low efficiency, and the total expenses per kilowatt-hour delivered are relatively high. Contrasted with this is the oil engine with its inherently high over-all efficiencies ideally suited for small power plants where oil is readily available, where solid fuel is expensive, where low load factor would cause high operating expenses.

In making this statement it is assumed, of course, that the oil engine is applied under proper conditions. It finds its special field of application in small municipal power plants, small utility electric light and power stations, in mines, also those industrial plants where, owing to the power demand, the owners are unable to obtain attractive central-station rates (excepting those plants where large quantities of steam are required in the factory processes). Where only general heating is required water from the engine jackets can be passed through low-pressure oil-fired or coal-fired steam boilers.

The economic changes this country is now experiencing have been under way for the past decade in Europe; hence engineers there were the first to appreciate the many advantages of the oil engine and the first to foster the development to its present high standard. In this country, however, conditions have not been favorable to the development of this prime mover until recently. As a result the typical American oil engine was designed and built to sell for the lowest possible price, until lately. This has been a serious limitation to its improvement. Furthermore, owing to the fact that the oil engine is comparatively simple to understand and operate, owners have hired the cheapest operating skill obtainable. As a result of these two conditions the general experience with oil engines has not been all that could be expected, from either the development or the operating point of view.

However, European experience has shown and is showing that the oil engine is capable of rendering the highest degree of reliable service and at the same time of utilizing liquid fuels with an attractive over-all plant efficiency* nearly twice as good as the best obtainable in large central stations and from three to four times as good as can be obtained in a small steam-driven power plant. For example, in a central station it is excellent performance to convert more than 12 to 14 per cent of the energy in the coal into useful energy at the busbars. A representative isolated steam-driven electric generating plant in this country, including even a modern uniflow condensing installation, will rarely show higher than 10 per cent returns from initial energy delivered to the equipment in the form of coal. The energy available in the form of fuel oil delivered to an oil engine is returnable in the form of useful electric energy at the switchboard to an extent of 20 to 25 per cent, in some instances as high as 30 and 32 per cent.

American manufacturers anticipated the now rapidly developing economic conditions, but the war precipitated these conditions in a comparatively short time. Hence the oil engine is rapidly undergoing a marked period of development in America both in design and in capabilities. The importance of first cost is being rapidly relegated to its proper place in relation to the other costs involved. Thus manufacturers are now in a position to pay more attention to the various features of design that have to do with the actual operation and maintenance.

From the owners' point of view, after a prime mover has once been installed and started up, the questions of operating and maintenance expense are probably the most important. The fuel costs depend largely upon the type of engine and the grade of oil on which it is capable of operating. The smaller engines of representative makes, as a rule, will run satisfactorily on kerosene and distillate oils as heavy as 28 deg. Baumé, or possibly 24 deg. Baumé, depending largely on the

*See Mark's "Handbook," page 1104; Kent's "Handbook," eighth edition, page 985; abstracts test reported by H. G. Stott in A. I. E. E. *Transactions*, 1906; A. S. M. E. *Transactions* 1916, page 743

oil source. The larger units will operate on still heavier oils. So-called medium and high-compression engines give good results when using practically any crude or fuel oil obtainable, including the various distillates and kerosenes. A great many engines in this country are operating to-day on some of the heaviest Mexican and Californian crude and fuel oils. The distillate oils are easily handled and, being more or less a by-product in the crude refining process, are comparatively cheap and easily obtainable.

As already mentioned, one of the great features of the oil engine is that, being comparatively a simple and self-contained prime mover, it can be operated by mechanics of varied intelligence. Almost any one who can open a few valves, turn on the air, start the engine and throw in a few switches may call himself an oil-engine operator, but unless he has a knowledge of its limitations and mechanical make-up, based on good previous experience, the owner is liable to find in the course of time that what he saves in having the cheapest of operating skill is more than offset by the subsequent repair and maintenance charges. For the ordinary stationary power plant the owner can well afford to hire good operating skill, especially when he takes into consideration the fact that no boiler-room help is required. A good conscientious corps of engineers of the same type as are typical in steam plants of equivalent capacity and in charge of later-day oil engines will show results that well justify the coming and rapid application of this type of prime mover.

It is very interesting to compare a typical oil-engine installation of some years back with what could be expected in the same installation were up-to-date oil engines installed. The plant under consideration consists of seven 250-hp. low-compression twin-cylinder oil engines. Mounted on the shaft of each unit between the cylinders is a 165-kw., 220-volt direct-current generator. There are also four 350-hp. vertical three-cylinder high-compression units with direct-connected 230-kw. direct-current generators. The first high-compression engine was installed in 1904, the first low-compression engine in 1906. The plant was completed in 1910. During the subsequent years they have been in constant operation except for a few months when the output of the factory was curtailed somewhat.

Data taken from a report for the fiscal year from July, 1916, to July, 1917, are presented in the accompanying table. Distillate oil is used as fuel, and the report is based on a cost of 7½ cents per gallon delivered. The maintenance and repair charges will appear rather high, but due allowance must be made for the fact that most of the engines have operated from ten to twelve years and are not at all representative of present-day larger-sized oil engines. Column B of this table gives data for the same plant equipped with up-to-date representative oil engines. These figures thus contrast what could be expected under the same conditions using old and modern oil engines. It is assumed that the new plant would be equipped with four 800-hp. multi-cylinder units and direct-connected generators. The initial cost of the equipment in this case is based on war-condition prices and so carries a severe overhead charge. The operating and maintenance charges are based on reports from typical later-day plants. The oil charges are taken the same as above.

Oil engines of the high-compression type suitable for stationary power-plant practice are built in this country in sizes as small as about 100 brake-hp. per cylinder. Competing with the high-compression type are the medium-compression engines, which are widely used and built in units as large as 600 hp. For the smaller sizes the solid-injection engine and the hot-bulb low-compression engine are used extensively. The latter is manufactured largely as a two-cycle unit and in the small sizes is rapidly forging into a prominent position in the field until recently held solely by the gasoline engine. The most recent development in the smaller engine sizes is the solid-injection type with both medium and high compression. Representative makes of the larger sizes are designed and built for constant full-load operating conditions. Their rated capacity is generally conservative, and so they have considerable overload reserve.

ANALYSIS* OF EXPENSES IN A PLANT EQUIPPED WITH OLD-TYPE AND NEW-TYPE OIL ENGINES

	A	B (4-800 Hp)
Initial investment	$204,870	$385,600
Interest	12,292.20	23,100.00
Depreciation (based on fifteen years' life)	8,788.92	16,542.00
Insurance and taxes	3,073.05	5,784.00
Attendance	16,400.00	11,800.00
Lubricating oils and supplies	2,200.00	1,500.00
Maintenance—labor	7,400.00	3,000.00
Supplies	3,202.00	2,000.00
Fuel oil	44,454.00	21,120.00
Water	1,061.00	800.00
Total annual cost of power	$98,871.17	$85,646.00
Total annual output in kilowatt-hours	4,477,300	
Average cost per kilowatt-hour	$0.0221	$0.0191

*There seems to be considerable dissension as to the probable life of power-plant equipment, so depreciation has been based on fifteen years' actual life. Interest at 6 per cent compounded annually gives a somewhat higher depreciation charge. The cost of fuel oil in the new plant is reduced to $21,120, which is still a liberal allowance for this charge. The fuel oil is taken at 7½ cents per gallon. This is an unusually high charge for fuel, as under normal conditions it is readily procurable at from 4 to 5 cents per gallon. The initial investment has also been increased so as to be consistent with present prices.

All of the various types and sizes give remarkable economies. The medium and the high-compression units show over-all efficiencies of from 30 to 36 per cent. These engines are therefore peculiarly well adapted for power development in small or isolated power plants. The larger-sized oil engines, especially the medium and high-compression types, can be made to operate on certain typical tar oils, English engineers having obtained excellent results during the war with fuels containing 90 per cent tar oil and 10 per cent petroleum or ignition oils. The logical tendency in efforts to conserve fuels should therefore be gradually to eliminate the present wasteful bee-hive coking system and substitute therefor the by-product coking system, thus making available, among the rest of the many useful byproducts which are obtainable, great quantities of tar oil.

In view of the various economic conditions pointed out above and the great possibilities offered by the oil engine in the way of maximum power returns for a given fuel consumption, it is only natural to expect that this prime mover will rapidly come into its own in American power-plant service.

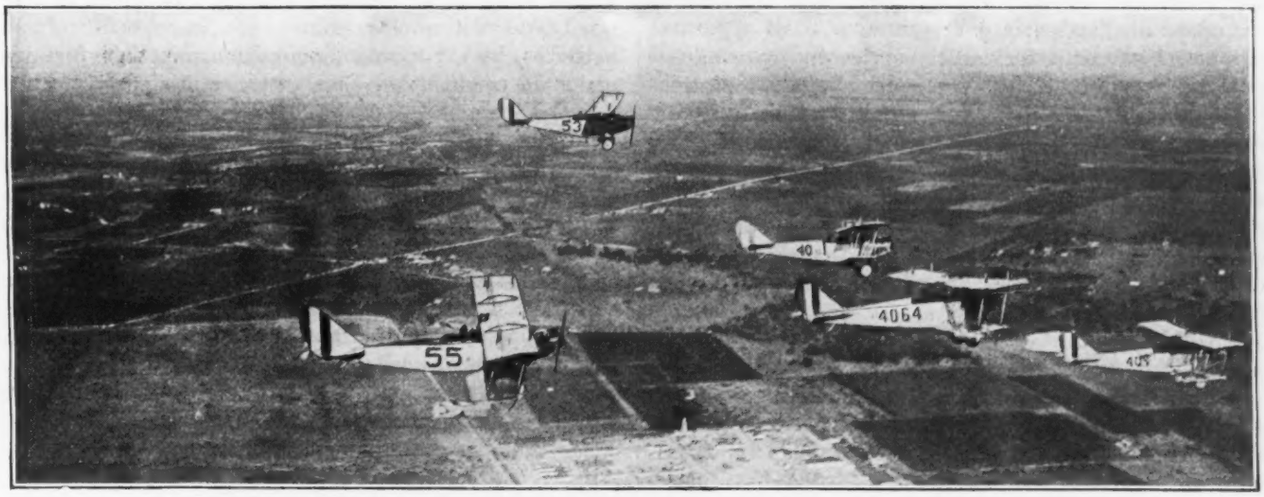


FIG. 1—GROUP OF AIRPLANES IN FLIGHT DIRECTED BY WIRELESS TELEPHONE ON THE GROUND

Military Radio Communication

Co-ordination of Army Operations Depends Upon Communication by Radio—Goniometric Stations Serve Important Purpose in Locating Enemy Units, While Telephone and Telegraph Systems at Listening Posts Intercept and Report Enemy Messages

BY CAPT. A. D. CAMERON, SIGNAL CORPS, U. S. A.

IN THE anatomy of an army the communication systems serve the same purpose as the nerves in the human anatomy. Sensations are instantaneously transmitted to a central point where information is consolidated and action directed. From the front-line trenches to the general headquarters is a network of telephone and telegraph wires linking together every unit. Wires are buried or laid in trenches in the most advanced sections. Farther back they rise to slender poles or saplings of low visibility. Beyond the range of enemy artillery begins the more orderly procession of line poles with spreading cross-arms. Paralleling the wire system in each divisional sector are a number of other signaling devices, for other agencies must be provided against the emergency when an unbroken line of communication will be vital.

Arm signaling and sound signaling may be employed over short distances. Visual signaling, using small searchlight projectors and sending Morse signals, increases the range of communications. Rockets and flares can be used to denote positions, to direct airplanes and to call for artillery support. Messenger dogs and carrier pigeons play a part in some operations. Mounted couriers and runners serve when other devices fail. But wires, whether buried or concealed, are not proof against shell fire. During heavy artillery bombardments wires are cut, poles are shattered, and repair men cannot by their own efforts keep pace with the rate of destruction. During the barrage at Soissons a wire one-sixth of a mile (270 m.) long had 350 distinct breaks in one day. Fogs, rain and the nature of the terrain may interfere with visual signaling devices. Pigeons go astray and runners cannot live under heavy shell fire. When such conditions obtain the integrity of the communication system is maintained by the network of radio.

To a certain extent this radio net is purely an emergency system, but as such it is installed and operated with the greatest of care. At each post of command, at each regiment, brigade, division, corps and army headquarters, at each air station and at each battery of artillery, is a detail of radio operators with apparatus installed and in working order every minute of the day and night. The net is "rung out" several times each day by sending short practice messages at irregular intervals. Maneuvers and tests are frequent. Everything is in readiness for the day when the barrage falls and other means of communication fail.

For company and battalion posts of command and at regiment headquarters there are combined transmitting and receiving sets, employing a loop antenna of one to three turns and one meter square, which are capable of transmitting signals over a range of 3 miles to 8 miles (4.8 km. to 12.8 km.) when installed in a trench or shell hole during the advance or in a deep dugout during attack. Between battalion and regiment headquarters this is supplemented by a wireless communication system which uses the earth rather than the ether as a transmitting medium, with an insulated antenna wire lying on the earth and grounded at certain intervals. At regimental and brigade headquarters are spark transmitting and receiving sets with low V-shaped antennas. For communication between brigade and division, division and corps, corps and army headquarters, continuous wave sets are used. Here distances are greater, there is little or no danger from the enemy's artillery, and antennas can be higher and apparatus more powerful. All this communication is arranged not only in depth but laterally along the battle front.

Radio apparatus forward of brigade headquarters is subdivided into units weighing not over 30 lb. (13.6 kg.)

and therefore easily portable. Such stations can be set up or dismantled in a few minutes. All apparatus is waterproof, built for severe service and with as few adjustments as possible. The continuous-wave stations at brigade, division and corps headquarters are carried by hand for short distances, but a special truck has been designed for division and corps headquarters which serves as an operating house for the radio apparatus and for transporting the reserve equipment when a division moves. Portability is an important item in an army where supplies, artillery and even troops are transported by motor.

Organization Prevents Confusion

It will be appreciated that this arrangement of apparatus presents endless possibilities of interference and confusion, and very careful supervision is necessary in regulating its operation. In the first place, sets are not more highly powered than necessary to work the required distance. The messages sent in a divisional net are very short and entirely in code. Call letters are allotted by schedule and frequently changed, while a very careful arrangement of wave lengths is in effect. For communication between ground stations sets in front of regimental headquarters are allotted certain wave lengths; between regiment and brigade, between brigade and division, from division to corps, from

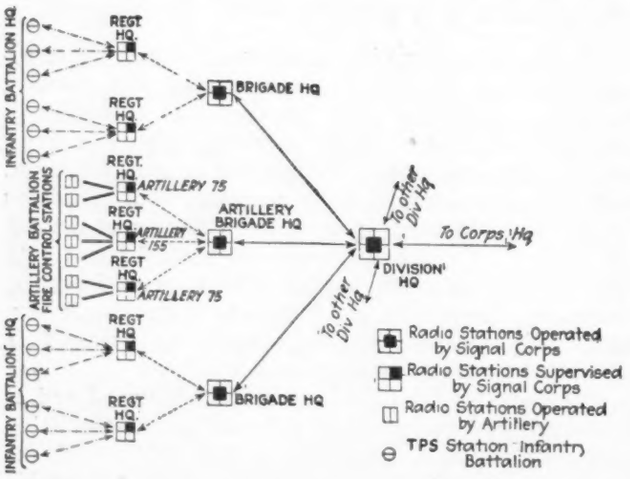


FIG. 2—ORGANIZATION OF ARMY DIVISION, SHOWING LINES OF COMMUNICATION, WHICH EXTEND BOTH AT RIGHT ANGLES TO AND LATERALLY ALONG THE FIGHTING LINES

corps to army, other wave lengths are in effect. Similar allotments are made in the air service and in all other branches equipped with radio. By subdividing these allotments among the various units and by utilizing different tone adjustments little difficulty is experienced in such a system under all conditions and reception is usually 100 per cent. A certain amount of interference may be expected from enemy stations, but very little of this is intentional since any "jamming" station would operate with equal effect on sets of its own side.

All radio sets in the division net are operated by dry cells or by storage batteries. Each set has a battery in operation and another fully charged in reserve. At division headquarters is a small gasoline-electric generating set for battery charging. Every radio station in a divisional sector is visited every second day by a light truck bringing fresh batteries and carrying back old batteries to the charging station. Batteries in forward positions are carried into the trenches, for fresh batteries, like food and ammunition, must go forward under all conditions.

Airplanes and Tanks Require Radio

In the Air Service radio is of greater importance since it maintains all communication between airplanes and ground stations and between airplanes in flight. The pilot in training may be directed by radio telephone by his instructor on the ground. Artillery fire is directed by fire-control airplanes or observation balloons equipped with a spark-transmitting set working direct with the batteries. Patrol planes, reporting to brigade and division headquarters, fly over the infantry in attack, to report progress and to call for reinforcements, supplies or artillery fire, using a spark transmitting set or perhaps a continuous wave set. Pursuit planes fighting in combat formation may be commanded by voice by the radio telephone. Day bombing airplanes may not only be voice-commanded by the flight leader but are in touch with headquarters by continuous-wave radio sets. Night bombers are equipped with radio telephone and also with direction-finding radio receiving sets. The latter apparatus makes possible navigation at night over unknown territory by determining the angle of reception of signals from two or more home beacon stations and determining position by triangulation.

Another important branch of the service which is utterly dependent upon radio for reliable communications is the Tank Corps. A number of other systems have been tried, colored flags, carrier pigeons, runners, but without complete success. The proposition of developing radio apparatus for operation in a tank presented several extremely unusual problems, but now signal tanks accompanying each formation of American tanks may carry continuous-wave transmitting and receiving sets for communication with airplanes, artillery and headquarters. The antenna may be a slender telescoping mast or a short collapsible umbrella. Transmission may be carried on during the progress of the tank over the roughest ground, but on account of the tremendous noise of the mechanism reception is possible only when the tank is stationary.

Intercepting Enemy Communication

Perhaps the most interesting use of radio in the war zone is in the intelligence service. Here radio is used, not for communication, but for intercepting communication, and there is a complete system for the interception of enemy radio messages and for the location of enemy stations. This service is distinct from the radio communication net and is controlled directly by army headquarters. The intercept stations are usually installed on a line with division headquarters at a comparatively safe distance from shell fire. The radio system consists of a receiving circuit with multi-stage, high-frequency amplifier and a V-shaped or umbrella antenna. The number of stations per division or corps depends upon the concentration of the opposing forces, but a sufficient number of stations are always in operation to handle all enemy traffic. The receiving sets are of several different types in order to permit reception of both spark and continuous-wave sets of wave lengths ranging from

100 m. to 2000 m. Operators are continually on duty to pick up all enemy radio communications, noting the exact time at which the message is received, the wave length, the call letter, the message itself and the sign-off. Daily reports are furnished to the army headquarters and to general headquarters, where they are immediately referred to the decoding experts. These daily reports yield a mass of information regarding the movements of troops and forecast impending events.

Operating in conjunction with these intercept stations are the goniometric or direction-finding stations, perhaps the most fascinating of all army radio work. The goniometric service is also under direct control of army headquarters. Covering one wall of a room in general headquarters is a map showing the entire battle front with the exact location of all enemy forces. This map shows the location of every army headquarters and the name of its commander, the number of corps operating under the army and the location of their headquarters, the number of divisions in the line and the location of division, brigade and regimental headquarters, the classification of the division, whether Prussian Guard, Bavarian Guard, etc., and its numerical designition. This ever-changing map is the result of coördinated intelligence reports from airplanes, prisoners and other sources, but the location of various headquarters is definitely fixed and verified by the radio goniometric service.

The goniometric stations are located not farther than 5 miles (8 km.) from the enemy trenches, closer than intercept stations because signals must be more than merely readable. They are arranged in groups of at least two stations and one control station. The number of stations depends entirely upon the characteristics of the battle front, whether a salient or reëntrant, and upon the concentration of opposing troops. Each station is equipped with a receiving circuit and an amplifier with a loop antenna. A station consists of a small wooden hut with a bench for the radio receiving set and with a vertical loop antenna from 6 ft. to 10 ft. (1.8 m. to 3 m.) square, projecting about the roof. This loop revolves on a heavy wooden shaft which passes through the center of the hut. Where this shaft passes through the bench in the hut is a metal dial graduated in 360 deg. and fractions thereof, and attached to the shaft of the loop is an index needle so placed as to touch lightly the surface of this dial as the loop is revolved. First the loop is oriented in such a manner that when the index needle on the shaft points to zero on the dial plate the plane of the loop is exactly east and west. The principle of operation is based upon the fact that a loop antenna is exceedingly directional. When the plane of the loop is parallel to the line of direction of the transmitting station, signals are loudest, and as the plane of the loop becomes perpendicular to the line of the transmitting station signals fade away. With very strong signals an experienced operator can detect within one or two degrees the exact direction from which the signals were transmitted. With the loop properly oriented and with the location of the goniometric station spotted on the map, it is possible to show the line on the map along which the signals pass. With two or more goniometric stations working on the same signal it is possible to determine with an astounding degree of accuracy the exact location on the map of the transmitting station. The strength of the signals, the characteristics of the note and the wave length used indicate the type of apparatus used for transmit-

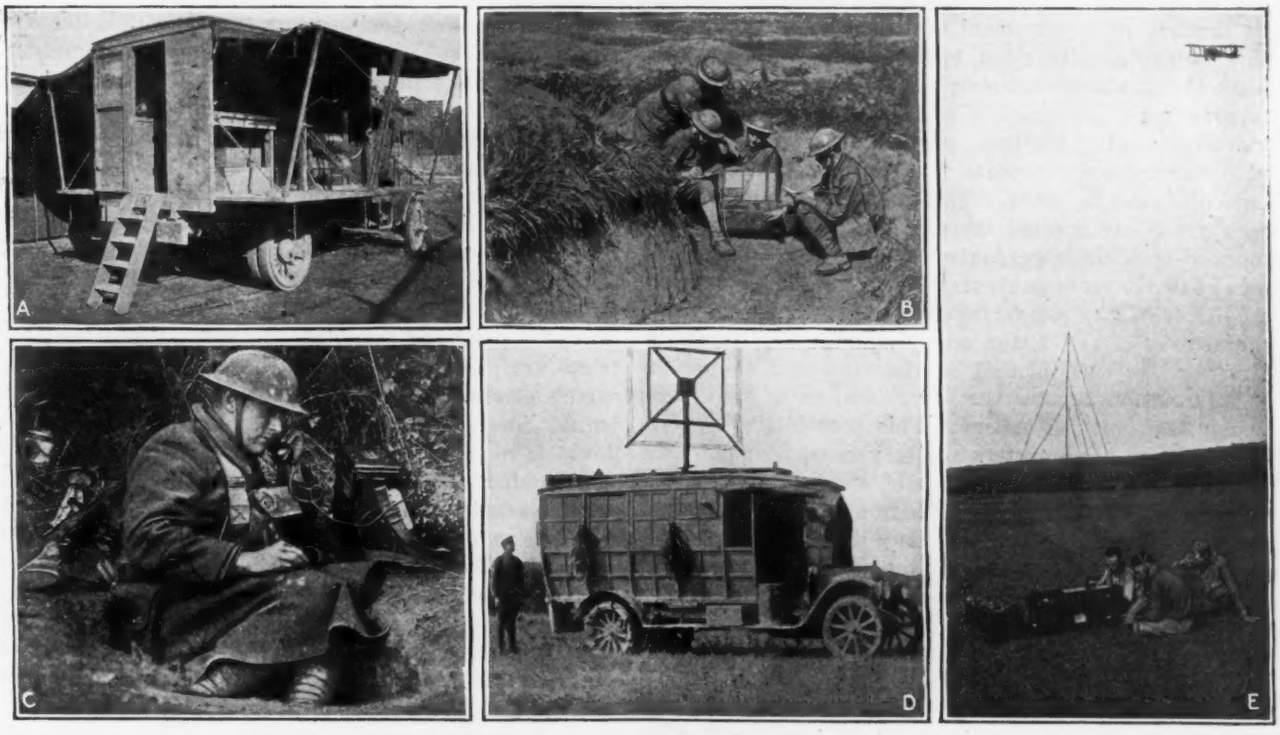


FIG. 3—EXAMPLES OF MILITARY COMMUNICATION IN THE FIELD

A—Radio repair truck for testing, repairing and battery charging. B—Inspecting a T.P.S. ground telegraph set in the trenches. C—Liaison officer of field artillery receiving orders from the first line. D—Mobile goniometric station with undamped wave transmitting and receiving apparatus. E—Radio-telephone conversation between ground and airplane.

ting and hence its probable classification as belonging to regiment, division, corps or army. The operation of such a station calls for the highest degree of skill in the reception of signals and in the operation of the loop. Practically all radio messages are sent in code and such codes are so arranged that the average message is not longer than thirty seconds.

Speed Required in Goniometry

In such a small margin of time the goniometric operator must tune for the proper wave length with his right hand, with his left hand rotate the loop slowly until signals fade out, then note the dial reading, continue rotation until signals again appear, note that point, revolve the loop through 180 deg. and take two similar readings. The angle between the two points where signals die away denotes the direction of the transmission station. The other two readings taken after the loop is revolved through 180 deg. act as a check on the first two readings and also compensate for any inaccuracies in the construction of the loop itself. In the meantime the operator has noted the exact time, call letter, sign-off, wave length, readings taken and remarks regarding tone characteristics and strength of signal. All this in thirty seconds. Such messages may be received at any moment of the day and night, and this radio detective must be constantly running over his scale of wave lengths and revolving his loop. The reports from goniometric stations are sent to their individual control stations, where they are consolidated with the intercept reports. A large map shows the immediate battle front. The goniometric stations of each group are spotted thereon and each spot is surrounded by a circle graduated into 360 deg. The readings of two or more gonio stations on the same messages are discovered by comparing the time, wave length, note characteristic, call letter and sign-off. The lines of direction are then plotted on the map, and the point of intersection denotes the exact location of that particular transmitting station. This consolidated report goes to army headquarters and to general headquarters and presents a daily statement of enemy radio traffic. The intercept report gives the body of the message; the gonio report tells the location. Each day the changes are noted on the big map. Enemy divisions move from one point to another, changing slightly the location of the transmitting station or the call letter. A raid verifies the fact and gives the designation of the new division. A new enemy headquarters is established—the goniometric station gets the location. That night it is bombed. Troop concentrations are detected and the necessary action is taken. Radio plays a most important part in such operations.

A variation of this goniometric operation serves as a detector of hostile aircraft. An airplane comes over the lines to drect the fire of an enemy battery. At the first range signal the goniometric stations take readings, and the local control station is notified by telephone. As the readings come in from the various stations they are plotted. When the exact course of flight is evident a telephone message to the nearest pursuit squadron brings action. Cases are on record where by this method enemy fire-control planes have been shot down or driven off within seven minutes after they crossed the lines. In these stations the daily reports are merely a confirmation of the day's business; in each case the action is immediate.

Another class of intercept stations which come directly under the supervision of army headquarters are the listening posts which are established for the purpose of overhearing telephone conversation and ground telegraphy (T.P.S.) communications of the enemy. They also serve the purpose of policing the telephone lines and T.P.S. communication systems of their own lines, disclosing what sort of information the enemy may be obtaining at his own listening posts.

Since the possibility of overhearing such communications depends upon the proximity of the listening post to the lines of communication of the enemy, these posts are placed rather close to the front-line trenches. In general, T.P.S. communication can be easily heard at a distance of 2½ miles (4 km.). Conversation over a single-wire, ground-return telephone system cannot be heard at a distance much exceeding 1¼ miles (2 km.) Telephone communications over a two-wire system insulated from the ground are never intercepted unless breaks occur in the telephone line or the insulation becomes faulty or otherwise grounded.

Equipment of Listening Posts

These listening posts are equipped with a low-frequency amplifier and have available for purposes of communication with neighboring units either a telephone, a buzzer phone or a T.P.S. transmitting set. The electrical phenomena which the listening posts make use of are elementary. The T.P.S. transmitting station receives its power from storage batteries and radiates by means of an insulated wire laid along the earth and grounded at certain intervals. A buzzer transformer is used for breaking up this power into signals. Through the earth, as a conductor, the current flows between grounded points of the wire. This establishes an electrical field which is limited by the character of the earth's strata and by climatic conditions. The equipotential lines are perpendicular to the lines of current flow. If two earth connections are made, not on the same equipotential lines, and if the wires leading to the earth connections are connected to a pair of telephone receivers, a current will flow through the phones. If the current is of sufficient strength, the T.P.S. buzzer signals will be heard. If the current is weak, it is necessary to insert an amplifier. This permits signals of very feeble intensity to be heard. This amplifier, two wires and the earth connections, or "earth antennas" as they are called, make up the essentials of a listening station. Such a receiving device picks up communications from a grounded telephone system in exactly the same way as from a T.P.S. transmitting station. An insulated telephone system presents a considerably different case, since reception at the listening post is possible only by induction. This may be done in two ways—first, by direct inductive action on the earth antenna of the receiving station; second, indirectly by inducing earth currents which are then picked up by the earth antenna of the receiving station.

These stations are in a dug-out with the earth antennas laid in trenches. In some cases three antennas are laid in the front-line trench or as far forward as conditions permit, with an additional antenna close to the station and another directly behind. The anten-

nas in the front-line trenches are for intercepting enemy communications, while those near the station and in the rear are used for interception of our own cummunications. These stations are installed at more or less regular intervals with approximately twelve to an army front. It may happen that for several weeks a station in a quiet sector will hear no signals from the lines of the enemy except the usual routine testing signals, but continual vigilance is necessary, because at any moment messages of supreme importance may be overheard, or its own lines of communication may be damaged to such an extent as to render it possible for the enemy to overhear important information. A station placed in an active sector before an offensive has the opportunity of intercepting practically the entire communication traffic of the enemy, because at such a time the artillery units, tanks, infantry, etc., advance nearer to the front-line trenches and use freely the various means of communication, especially T.P.S. sets and grounded telephone systems.

Listening posts furnish reports daily to general headquarters, to army headquarters and to division headquarters, and in an emergency information is transmitted direct to the nearest battalion or regimental headquarters. The service rendered by these listening posts has been of the greatest value in anticipating and checking movements of the enemy. Unlike the intercept station, the listening post is nearer the centers of activity and is able to intercept emergency messages, which are transmitted only by telephone or T.P.S. For the work of the western front the best operators for listening posts were found to be men who were not only expert operators but who spoke German fluently and had at least a high-school education. They were then trained in German military terms and even in up-to-date German slang as used by telephone operators. The service was sufficiently exciting to satisfy the most adventurous. The listening posts were within easy range of the enemy artillery, and the earth antennas had to be constantly inspected, particularly after bombardments, to repair breaks.

Another service which radio renders in military communications is in the simultaneous transmission to a large number of receiving stations of such meteorological data as weather forecasts, ballistic data, standard time, etc. This information has proved of the utmost value. Weather forecasts are essential to practically all branches of the service in determining the most favorable moments for attack. The probable occurrence of fogs, rains and prevailing winds is particularly interesting to the Air Service, to the chemical warfare organizations in the projection of gas attacks and to the artillery in determining range cards. Standard time was particularly essential in a war which depended so entirely upon the closest coördination on the simultaneous efforts of so many varied branches of service. At a certain given minute the artillery preparation must change to a barrage, which moves at a certain rate of speed. The infantry leaves the trenches and advances under cover of the barrage. At a certain moment the barrage lifts. The action is accompanied by tanks, airplanes and other agencies. All effort must be coordinated to obtain the desired results, and such coördination can only be secured by a common exact knowledge of time and conditions.

THE DETERMINATION OF HARMONICS IN CIRCUIT

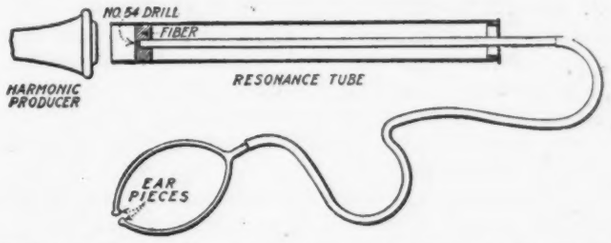
Method of Determining the Harmonics in an Alternating-Current Power Circuit That Causes Inductive Interference with a Telephone

BY F. T. IDDINGS

Chesapeake Potomac Telephone Comp any, Baltimore, Md.

A SIMPLE acoustic arrangement permits ascertaining the presence and the order of a prominent harmonic in a power circuit that is causing interference with an adjacent telephone circuit. It is essentially an organ pipe of adjustable vibrating length which can be brought into resonance with one of the harmonics of the humming diaphragm of a telephone receiver. From the distance between two consecutive nodal points the number of vibrations of the sound may be computed, and this gives the frequency of the corresponding electric harmonic.

An exploring coil of 500 turns of No. 28 D.C.C. wire is used, wound in the tire groove of a 2-in. (71-cm.) wooden bicycle-wheel rim. The coil is paraffined, taped, varnished and supplied with terminals to receive the tips of a bipolar telephone receiver cord. This coil is placed in inductive relation to the source of the interfering currents, and a bipolar telephone receiver in series with the coil is placed before, but not tightly against, the open end of the resonator tube described below.



TUBE CAN BE MADE RESONANT TO ANY PARTICULAR FREQUENCY

The adjustable resonator is made of 1-in. (2.5-cm.) outside-diameter brass casing, $\frac{1}{32}$-in. (0.8-mm.) wall 25 in. (65 cm.) long, with piston of $\frac{1}{4}$-in. (6-mm.) outside-diameter brass tubing 26 in. (66 cm.) long, sliding through a hole in the cap on one end of the larger tube. Screwed onto the end of the small brass tube is a piston head of $\frac{1}{4}$-in. (6-mm.) fiber, the bore of the small tube being continued through the piston head by a small hole (No. 54 Morse drill). The piston head must slide freely in the bore of the larger tube and yet fill the whole bore. On the end of the small tube which projects through the cap of the larger tube there is placed 2 ft. (60 cm.) of flexible rubber tube terminating in ear pieces such as were used formerly with phonographs.

With a humming receiver near the end of the tube, the sounds due to the interfering currents are plainly heard through the ear tubes. If now the piston be withdrawn slowly into the tube, thus enlarging the resonating chamber, a point will be noted where a certain tone is much louder than at any other points. Still further withdrawing the piston, another resonant point will be found for each tone, about twice as far from the first maximum point as the first point is

from the open end of the tube. The distance between the first and the second maximum points will be a half wave length of the harmonic. Doubling this length and dividing by it the distance which the sound travels in one second, *i.e.*, 13,440 in. (20,160 cm.) will give the frequency of the harmonic.

Should there be two harmonics of prominence which are close together, say the eleventh and the thirteenth on a 60-cycle line, the result from the resonator will likely be the twelfth harmonic. This will be clear from the following table:

Harmonic Number	Half Wave Length
Eleventh	10.18 inch
Twelfth	9.33 inch
Thirteenth	8.61 inch

The ear will probably select as the center of the maximum the point where the two harmonics overlap and thus get the average wave length, corresponding to the twelfth harmonic.

A resonator of the dimensions given would not give the half wave of a harmonic lower than the seventh on a 60-cycle system, *viz.*, 420 cycles per second. To measure frequencies as low as the third harmonic on 60 cycles would require a tube 56 in. (142 cm.) long.

Engineering Aspects of Industrial Lighting—IV

Examples of the Illumination of Manufacturing Establishments During the War When Maximum Production Was Essential Are Pointed Out, and the More Important Aspects of the Economic Side of Industrial Lighting Are Considered

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

THE economic advantages not only of the best in factory lighting but often of intensities of illumination materially higher than values which have been considered good practice in the past have been outlined in fairly complete form in the preceding installment of this series. These advantages are not merely abstract ideas that are applicable in a general way to industrial lighting questions, but they are often reflected in modern plants by the excellence of lighting systems which have received the careful study of plant managers in advance.

It is the purpose in the following notes to give special attention to several of these encouraging reports[1] which have been received during the last few months and thereby to illustrate through actual examples some typical installations in the better lighted industries, as well as to give a number of opinions which have recently been advanced in connection with both natural and artificial lighting. These examples will logically fall into two general classes—first, those cases where standard practice is shown for the older plant structures; second, those where new buildings are chiefly concerned.

While cases have come to the attention of the writer where the most elementary principles of good lighting have been violated in buildings used as part of the war program, it is gratifying to have reports from war industries in which the lighting problem, even during the war, has received the most careful attention and where the results have been equally satisfactory.

The pressure of the war emergency was felt in the rapid expansion of some of the plants, and one of these, as more or less typical of the older established munition factories, has experienced a very rapid expansion and may be taken as the basis for some interesting details resulting directly from the field observations. The plant in question has been expanded from 800 to 8000 employees, thus calling for a considerable amount of new building. The older buildings are of a common form of brick factory construction with beams spaced on centers of 8 ft. (2.4 m.) and with window spaces 4 ft. 6 in. by 9 ft. (1.37 m. by 2.7 m.), resulting in a ratio of window area to floor area of one to eight.

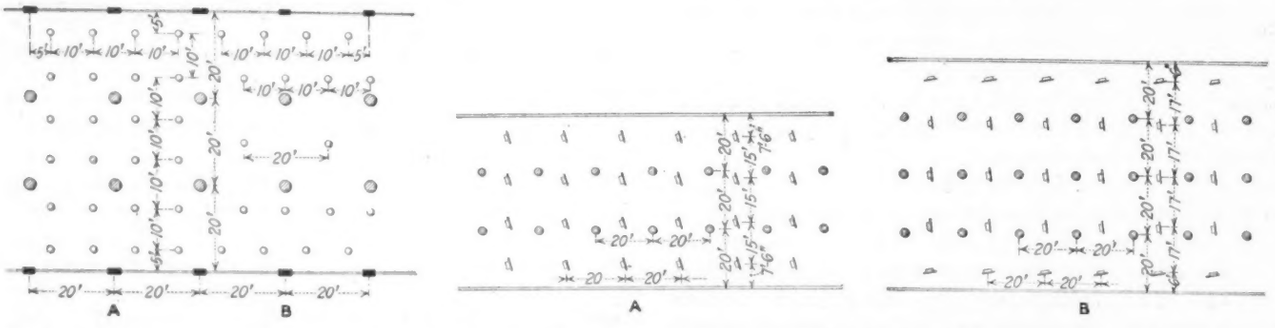


FIG. 1 A AND B—STANDARD LAYOUTS FOR GAS-FILLED LAMPS IN A MODERN INDUSTRY; FIG. 2—REPRESENTATIVE ARRANGEMENTS OF MERCURY-VAPOR LAMPS IN A PROGRESSIVE PLANT, A FOR NARROW BUILDING AISLES AND B FOR WIDER BUILDINGS

The new buildings are of reinforced concrete construction, are 60 ft. (18.3 m.) wide with concrete columns in two rows, dividing the plant into bays of 20-ft. (6.1-m.) width, and with a 10-ft. (3-m.) aisle extending the full length of each shop down the center. In these new buildings outlets are spaced on 10-ft. by 9-ft. (3-m. by 2.7-m.) centers and are equipped with 100-watt gas-filled lamps in Benjamin enameled fixtures of the steel-dome type. Bowl-frosted lamps are preferred.

This general scheme of artificial lighting is reported as ample for many of the operations, among which are mentioned profiling, power and hand milling, broach-

[1]Based in general on material gathered for the employment management division of the War Industries Board and herewith published by permission of that division of the board.

ing, gun boring, reaming and rifling, and for wet grinders. This is a rather interesting statement, for it confirms the rough figure of, say, 1 watt per square foot (10 watts per sq.m.) which has been mentioned as a fair average of value for good lighting practice in certain industrial cases. In the foregoing divisions of the plant in question the general lighting is reported as adequate without the use of individual lamps.

In those sections, however, typified by work on lathes, automatic screw machines and drill presses, the general lighting has been found inadequate for discerning the

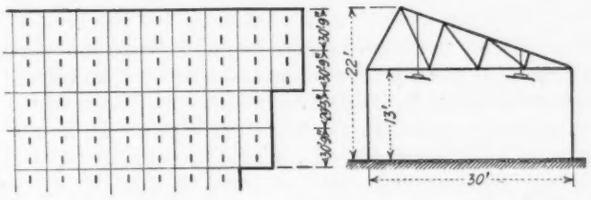


FIG. 3—ELEVATION AND PARTIAL PLAN, SHOWING THE ARRANGEMENT OF MERCURY-VAPOR LAMPS IN A SHELL PLANT

action of the tool on the work and the index graduations on the machines themselves. Here individual lamps of the 40-watt size are installed to supplement the general lighting. Moreover, in such departments as the filing, fitting, assembling and inspection sections it has been considered necessary to employ individual lamps, and where the men require the lamps very close to the work —for example, in filing or assembling—the White adjustable bench fixture is used, this device being adjustable in every direction. The advantages of permitting these workmen to adjust their lamps conveniently to the work is apparent. Metal half shades of the Hubbell type are used in conjunction with these adjustable fixtures, this obviously being an important item in glare prevention.

In those cases where it has been found necessary for the workmen to move the lamps with an overhead flexible suspension drop cords are employed, and the 40-watt lamps in such cases are equipped with a tin cone shade. An interesting feature here is the vertical adjustment of these lamps by a cord which passes over two pulleys and is connected to the lamp cord and a counterweight. This scheme makes it possible for each workman to raise his lamp and to place it in a position out of the way when not required.

In the older buildings of this plant the common practice has been to use 200-watt lamps equipped with Benjamin enameled steel-dome fixtures, mounted 10 ft. (3 m.) above the floor and about 10 ft. apart. The presence of countershafting and belting in these older shop sections has, however, frequently made it necessary to modify these spacing distances. In other cases aisle lighting has been resorted to; thus in one section two sets of power milling machines were arranged to face each other with the workmen occupying the aisle. Here the lamps are arranged in the aisles and illumination is furnished to both rows of machines. Where a better distribution of illumination is required than that secured by the 200-watt gas-filled lamps, smaller units of the 100-watt size are used with enameled steel-dome fixtures.

An interesting feature in this plant is the office and drafting-room lighting. In one of the new drafting rooms "Brascolite" fixtures with translucent bowls are used with 300-watt lamps. This is reported as a very satisfactory system with 20-ft. (6-in.) spacing for the outlets and the units 10 ft. (3 m.) above the floor, and the absence of all drop lamps for the drafting tables is an indication of the satisfactory condition of the general overhead lighting. Equally satisfactory conditions are reported for the offices in this plant with the same general scheme of overhead lighting.

It is perhaps only proper to state at this point that the ideas advanced in the foregoing notes and in those to follow, and particularly where comments are made on specific types of equipment, must be accepted by the reader as comments from men in the field who have attempted in the recent war emergency to give definite opinions on their experience with given equipment as an aid to other war industries. For obvious reasons, therefore, the writer cannot, under these circumstances, be held as either favoring or differing from such ideas as may be presented on specific types of equipment, and all the opinions of this character are therefore placed before the reader for what they may be worth at this time.

GOOD ILLUMINATION PAYS

Turning now to another interesting case, it has been found in a second large plant that good lighting has been a paying investment from the start of the industry. This is brought out by a statement at the very outset of the report which deserves notice on the part of other plants where the advantages of the best in lighting may not yet be so clearly recognized. The statement referred to is as follows: "I regret to say that we have no comparative data on the effect on production of good and inferior lighting, as we have always installed good lighting from the time the plant was built."

The foregoing statement apparently is possible because of the more recent establishment of the industry in question, but it may be observed that this plant is one of the larger and more modern automobile organizations where such factors as good lighting have received careful attention from the beginning of the industry. A number of diagrams are available show-

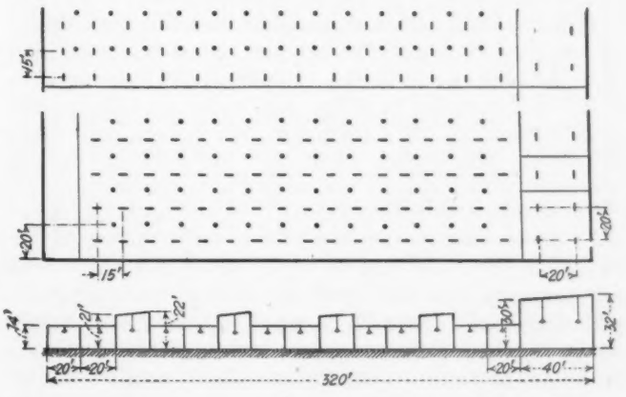


FIG. 4—PLAN OF MERCURY-VAPOR LAMPS IN A MUNITION PLANT

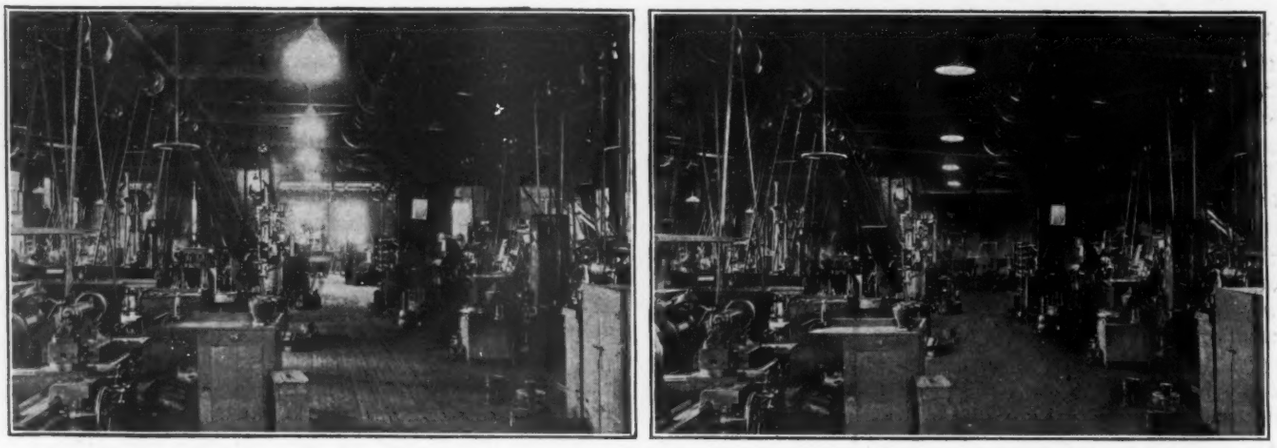
ing the typical layouts of the lighting equipment in this establishment, and these are of particular interest —first, because they indicate methods which have been adopted and which have been considered as successful in a given large plant; second, because they indicate further the ideas of good practice on the part of the electrical department in a large manufacturing organization.

Reference is made first to Fig. 1, part A, where the use of 100-watt gas-filled lamps is shown. Here the spacing distance between lamps is seen to be 10 ft. (3 m.) with 5 ft. (1.5 m.) between edge lamps and walls. Note the symmetry of this arrangement in respect to columns and walls, and also, here again, to the adoption of about 1 watt per square foot (10 watts per sq.m.) for a standard of good general illumination. Each lamp in the installations of both A and B in Fig. 1 is equipped with a 14-in. (35-cm.) porcelain-enameled reflector and is mounted about 10 ft. (3 m.) above the floor.

Fig. 1, part B, shows a plan somewhat similar to part A of this same figure, with the exception that the central aisles are equipped with one lamp per bay rather than four, and also that the lamps in adjacent rows are arranged according to a staggered scheme. The elimination of three of the four aisle lamps per bay is due to the fact that these central bays are not devoted to manufacturing purposes.

Figs. 5 and 6 are included to show companion day and night views of the illumination produced with recently designed units for industrial purposes. The under shallow glass bowl of these units (seen more clearly in Fig. 6 is intended as a protective feature for the eyes of employees, with some sacrifice, of course, in the light-giving efficiency of the unit as a whole. Efforts to minimize glare from brilliant lamps, as typified by Figs. 5 and 6, are highly commendable and are in the direction of reducing one of the greatest evils of many existing factory-lighting systems.

A number of interesting conclusions may be derived from the reports used as a partial basis for the present article. First, perhaps, should be mentioned the care which these reports indicate has been devoted to highly adequate lighting in industries which have been working under the pressure of war conditions. It is apparent that not all cases of structures devoted to war work have been characterized by equal care in the lighting plans, and cases might be cited to show where op-



FIGS. 5 AND 6—NIGHT VIEW OF SHOP EQUIPPED WITH A NEW TYPE OF REFLECTOR FOR PREVENTING GLARE; DAY VIEW IN THE SAME SHOP, SHOWING THE GENERAL LIGHTING EFFECT WITH ONE TYPE OF INCANDESCENT LAMP EQUIPMENT

In this plant the layouts corresponding to Fig. 1, parts A and B, may be looked upon as standard for use in such departments as assembling, painting, upholstering and top building, for sewing rooms and the like. Of great importance to the success of the lighting systems is the recorded fact that the walls and ceilings are painted white and are kept reasonably clean. Obvious advantages also result from the flat ceilings in the buildings, which are of concrete construction.

For machining operations this plant uses mercury-vapor lamps mounted from 10 ft. to 12 ft. (3 m. to 3.7 m.) above the floor, and in buildings of the same general consruction as that applying to Fig. 1 an arrangement like Fig. 2, part A, is employed, this case being one in which relatively narrow buildings are involved. For wider buildings, with the saw-tooth roof construction, the machining sections are equipped with mercury-vapor lamps as in Fig. 2, part B.

General arrangements in portions of large munition plants are indicated in Figs. 3 and 4. Both of these figures represent layouts of mercury-vapor lamps on a large scale, and the type F unit is employed in the two cases corresponding with Figs. 3 and 4. Special attention is directed to the elevations in these two cases, which indicate clearly the solution that has been made of the lighting problem with regard to the structural details of the plant.

portunities for producing a good lighting effect have been overlooked and where the results have been anything but satisfactory and effective. Such cases have often undoubtedly been due to ignorance on the part of those who planned the system, although the scarcity of suitable lighting equipment at the time the installation was made may also readily have been a handicap to the attainment of good results in some cases.

The several instances mentioned in the foregoing notes, however, contain items of excellence which point to the advances in the art of industrial lighting during the immediate past, and the results obtained in these cases are undoubtedly far better than would have been realized in the same plants under similar circumstances twenty years ago.

DROP CORDS SHOULD HAVE REFLECTORS

A second point which these reports evidence is the growing attention devoted to the reflector proposition. The emphasis placed upon reflectors for drop lamps as a protection for the eyes of employees and upon the types of reflectors for lamps mounted overhead constitute items of encouragement for those departments of labor in various states where efforts are being made to educate manufacturers generally up to this very point. In fact, in one report specific mention is made by the writer of contemplated tests on quite a variety

of types of reflectors for tungsten lamps, for the purpose of obtaining comparative data for the benefit of the plant in its choice of lighting equipment.

A third point relates to the emphasis placed upon the use of individual or local lamps in certain cases. It is assumed by the writer, in going over one of the reports mentioned above, that the emphasis placed upon local lamps is not to the exclusion of an adequate system of general lighting. The importance of this point has been discussed in a former article of this series from the standpoint of accident prevention, and it is an item which demands considerable care in this connection.

It is very easy to see, however, that where the general lighting system is intended more as a means for furnishing some light to spaces between machines than for the illumination of the machines themselves drop lamps might be essential to the satisfactory conduct of the work in hand.[2]

IMPORTANT TO CONSERVE THE NEW ENGLAND WATER POWERS

Henry I. Harriman Says that That Section Can Absorb All Water Power Which Can Be Developed Within Its Limits

Henry I. Harriman, president of the New England Power Company, addressed the New England Forestry Congress at Boston Feb. 24 upon the water-power situation, emphasizing the importance of conservation through development and utilization and touching upon the latent resources of that section of the country. On the assumption that the average run-off in New England is 18 in. (45.7 cm.), that its area is 60,000 square miles (15,540,000 hectares) and that its average elevation above sea level is 900 ft. (275 m.), it is computed that it would be theoretically possible to develop for 3000 hours of every year 15,500,000 hp., or the equivalent of using 52,000,000 tons of coal annually.

"Of course," said Mr. Harriman, "such a computation is nothing but an interesting mathematical calculation. It is, however, entirely possible that 10 per cent of this theoretical power may some time be developed from its streams and that New England may be able to produce energy equivalent to that yielded by 5,000,000 tons of coal."

The speaker pointed out that the eight largest rivers of New England have a total fall of 10,169 ft. (3000 m.), draining 35,000 square miles (9,000,000 hectares). Because of their great watershed and large drop, these streams—the Penobscot, 1500 ft. (457 m.) fall; Kennebec, 1000 ft. (304 m.); Androscoggin, 2200 ft. (670 m.); St. Croix, 400 ft. (121 m.); Saco, 1900 ft. (579 m.); Merrimac, 269 ft. (81 m.); Connecticut, 2000 ft. (609 m.), and Housatonic, 900 ft. (274 m.)—are New England's greatest sources of present and future power. Along them are found the greatest water-power developments and manufacturing centers.

An estimate has been made by the federal government that in New England there is now developed and used more than 600,000 hp. of water energy, but that these same water powers, if properly reconstructed along scientific lines, could generate an additional 200,000 hp. It is also estimated that it is possible to create in New England a minimum water-power development of 1,000,000 hp., which by storage and by the utilization of some of the less desirable power ultimately can be increased to 2,000,000 hp. Maine leads in both developed and undeveloped water power, having a maximum possible development of nearly 1,000,000 hp. The power of New Hampshire, Vermont and Massachusetts is reckoned at from 200,000 hp. to 300,000 hp. each; Connecticut has 160,000 hp., and Rhode Island a possible 16,000 hp.

"There is little doubt," Mr. Harriman said, "that New England can absorb all the water power which can be developed within its limits, for it is one of the greatest and most diversified manufacturing centers of the country. The Census Bureau gives the total value of manufactured products of the United States at $20,000,000,000. New England, with about 2 per cent of the area of the country and about 4 per cent of its population, produces more than 10 per cent of this total."

Mr. Harriman said that it would not be profitable to make hydroelectric developments on the New England rivers on the basis of their minimum flow, and it is therefore customary to make the development on the basis of a flow which can be counted on for six or seven months of the average year, the deficiency being made up by storage or by the use of steam relay. Very considerable progress has been made in the development of storage and in the conservation of flood waters in spring. A dam at the outlet of Moosehead Lake impounds more than 30,000,000,000 cu.ft. (about 1,000,000,000 cu.m.) of water and has more than doubled the minimum flow of the Kennebec River at Augusta. The storage on the Rangeley Lakes has raised the minimum flow of the Androscoggin at Rumford Falls and Berlin to about 2000 sq.ft. (about 180 sq.m.), this storage having been created by the coöperative effort of all the power users on the river. On the upper waters of the Deerfield, in Vermont, the Somerset reservoir is now storing water sufficient to produce in existing plants approximately 25,000,000 kw.-hr. per year which would otherwise be wasted.

Mr. Harriman touched briefly upon forestation in relation to minimum stream flow. Unforested drainage areas always produce what are known as "quick" streams. Fortunately for New England, most of its territory was originally a forest area, and in this region reforestation is not so important as the conservation and proper cutting of the forest area now in hand, and it is particularly important in this connection that when the forests are cut over the small trees and the underbrush be left intact. This will to a great degree protect the forest humus, which is the great "sponge" that absorbs and holds the rains. The water powers of New England are to-day producing more than 2,000,000,000 kw.-hr. of energy yearly, saving an annual coal consumption of about 3,000,000 tons. While the merits of different types of prime movers may be discussed, in the long run it appears certain that the energy of falling water will be utilized to the fullest extent and that the powers of our streams will be made to do useful work for the benefit of mankind.

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[2]In the compilation of these notes the writer is indebted to the Macbeth-Evans Glass Company and the Cooper-Hewitt Electric Company; also to Louis A. Cressy, electrician Colt's Patent Fire Arms Manufacturing Company, and M. A. Van Norman, chief electrician Hudson Motor Car Company.

New Security Issues of Electric Utilities

Recent Capital Issues of About Fifty Companies Furnishing Electric or Combined Utility Service Reach Total of $110,000,000 and Mean Continued Expansion of Plants to Meet Demands for Electrical Energy

DESPITE adverse conditions in the investment markets, a number of electric utilities have been successful recently in marketing securities. The accompanying list summarizes information available on offerings of such securities by bankers, applications for authorization laid before state public service commissions or reports of plans to put out new stock or bonds. These amounts total over $110 000,000. That sum is of course, small in comparison with the real capital needs of the electric utilities of the country. It is significant, however, that these properties have been able to put out securities on any acceptable terms in the prevailing situation.

About fifty companies are included in the list, and most of the financing is for small amounts. It will be seen that the average sum per company is roughly $2,000,000. When it is stated that five of the companies represent $51,000,000, or nearly one-half of the total, it will be seen that the average for most of the properties is very small. The five companies whose borrowing shows this large total are the Philadelphia Company of Pittsburgh, the Public Service Corporation of New Jersey, the Southern California Edison Company, the Pacific Gas & Electric Company and the Great Western Power Company.

In justice to their community requirements many of the companies have been unable to postpone their financing any longer. They are obliged to place orders for electrical apparatus in advance of their actual needs and must have capital to meet their obligations. In order to plan construction ahead with confidence they must in fact have reasonable assurance that when capital is needed it will be forthcoming. The successful issue of securities at this time is a fair indication that the investment market will be able to provide more funds for expansion later in the year when government loans are out of the way.

With the great issues of Liberty bonds on the market and the Victory loan impending, the disposition of the companies is to postpone financing. This course is recommended not only by the government priority of interest in investment funds but also by the current high rates for money. Companies are not anxious to burden their operations any more heavily than is necessary for interest on securities issued on the only terms open now. The are in urgent need of capital to meet expenditures for additions required by the public demand for energy, but it is important for them to borrow as cheaply as possible.

It was to have been expected that cost of capital would be raised to high figures by the present unprecedented conditions. The indicated costs, however, are not by any means high in comparison with prevailing prices of similar securities already on the market or with issue prices of new securities. On the contrary, they show that the credit of electric utilities ranked well in a market in which the best-secured obligations of nations and corporations are regarded critically.

In at least one conspicuous instance the securities were offered directly to the public in the communities served instead of through the regular investment banking channels. Successful selling of securities directly to the investment buyers in this way has the advantage that it involves less expense than the usual commission changed by bankers. It also frequently attracts private capital from people who are not ordinary investors in touch with the customary banking houses.

It is of special interest to note the financing plans of Pacific Coast companies. These involve relatively large amounts and indicate plans to make substantial expansions in plants. It is evident that a material part of the outlay for new construction in that section of the country will be for development of hydroelectric resources.

As many electric utilities are joined with other classes of utilities under single corporate control the statistics given do not relate wholly to electrical construction The large proportion of purely electric utilities represented in the list, however, is assurance that most of the capital issues mentioned will go to increase electric systems.

Undoubtedly the list includes some cases of refunding operations. To the extent that it does so, it does not represent new capital for enlargement of plant. In general, it is believed to mean considerable fresh capital for expansion. Viewed in this way it is, as indicated, significant of an investment standing that enables these properties to dispose of securities under adverse influence. It is, moreover, a foretaste of a great output of securities to meet the enormous construction requirements of the future.

EASTERN COMPANIES

American Railways Company, Philadelphia.—Issued $3,000,000 7 per cent three-year notes, dated Feb. 1, 1919, $1,672,000 to retire a like amount of notes maturing on that date, balance being offered at par by Newburger, Henderson & Loeb and Bioren & Company, Philadelphia.

Brooklyn Edison Company, Inc.—Guaranty Trust Company, New York, offered $5,500,000 general mortgage 5 per cent bonds, due Jan. 1, 1949, at 91 and interest.

Central Hudson Gas & Electric Company.—Authority given by New York Public Service Commission, Second District, to issue $750,000 debenture bonds carrying privilege of conversion at par into stock on Jan. 21, 1921.

Cohoes (N. Y.) Power & Light Corporation.—The First National Bank and Hemphill, Noyes & Company, New York, offered $2,500,000 first mortgage 6 per cent bonds, dated Jan. 1, 1918, due Jan. 1, 1929, at 102½ and interest.

Erie (Pa.) Lighting Company.—Brown Brothers & Company offered $1,350,000 first mortgage 5 per cent sinking fund bonds, due April 1, 1967, at 88 and interest.

Lockport (N. Y.) Light, Heat & Power Company.—Howard R. Taylor & Company, Philadelphia, offered $350,000 general mortgage 7 per cent bonds, due Jan. 16, 1920, guar-

anteed principal and interest by United Gas & Electric Company of New Jersey.

Lowell (Mass.) Electric Light Corporation.—Issue of 2,941 shares of stock proposed.

Municipal Service Company.—Baker, Ayling & Young offered $700,000 6 per cent debenture bonds, dated Dec. 2, 1918, due December, 1928, to yield 7 per cent.

New England Power Company.—Baker, Ayling & Young, Boston, offered 6 per cent preferred stock.

Niagara, Lockport & Ontario Power Company.—William Solomon & Company, New York, offered $990,000 refunding mortgage 6 per cent bonds due Feb. 1, 1958, at 93 and interest.

Philadelphia Company, Pittsburgh.—Sold through Lee, Higginson & Company and First National Bank, New York, $10,000,000 three-year 6 per cent secured notes, dated Feb. 1, 1919. Price, 96½ and interest.

Philadelphia Electric Company.—Brown Brothers & Company and Drexel & Company, Philadelphia, offered $1,500,000 first mortgage sinking fund 5 per cent bonds, due Oct. 1, 1966, at 94 and interest.

Pittsfield (Mass.) Electric Company.—Increase of $125,000 in stock reported.

Public Service Corporation, Newark, N. J.—Bonbright & Company, New York, and Drexel & Company, Philadelphia, sold $12,500,000 three-year secured convertible 7 per cent notes, dated March 1, 1919, at 98½ and interest.

Rochester Railway & Light Company.—Asked New York Public Service Commission, Second District, to authorize issue of $500,000 preferred stock.

Syracuse Lighting Company.—Authorized by New York Public Service Commission, Second District, to issue $920,000 6 per cent notes due Jan. 1, 1929, to fund outstanding notes.

Turners Falls (Mass.) Power & Electric Company.—Stock increased by $2,409,100.

Worcester (Mass.) Electric Light Company.—Authorized to issue $400,000 stock.

CENTRAL WESTERN COMPANIES

Cincinnati Gas & Electric Company.—A. B. Leach & Company, New York, offered $550,000 first mortgage 5 per cent bonds at 95 and interest.

Cleveland Electric Illuminating Company.—National City Company and Spencer Trask & Company, New York, offered $2,500,000 first mortgage 5 per cent bonds, due April 1, 1939, at 94½ and interest.

Commonwealth Edison Company, Chicago.—Illinois Trust & Savings Bank, Chicago, sold $4,000,000 first mortgage 5 per cent bonds to net about 5½ per cent.

Commonwealth Public Service Company.—W. G. Souders & Company offered $600,000 7 per cent notes dated March 1, maturing $300,000 in one year, $300,000 in two years.

Galesburg (Ill.) Railway, Lighting & Power Company.—Illinois Public Utilities Commission asked to authorize issue of $350,000 consolidated and refunding mortgage bonds.

Louisville Gas & Electric Company.—Bonbright & Company, Inc., New York, offered $228,000 bond-secured 7 per cent notes, dated March 1, 1918, due Sept. 1, 1920, at 98½ and interest.

Merchants' Heat & Light Company, Indianapolis.—Paine, Webber & Company offered at 99½ and interest $7,000,000 one-year 7 per cent notes dated March 1.

Milwaukee Electric Railway & Light Company.—Offered $3,600,000 five-year 7 per cent secured notes, dated Nov. 1, 1918, due Nov. 1, 1923, at par, convertible into Milwaukee Light, Heat & Traction Company general mortgage bonds.

North West Utilities Company, Chicago.—W. G. Souders & Company, Chicago, offered $1,000,000 6 per cent collateral notes, dated Jan. 1, 1919, due in varying amounts each Jan. 1 to 1929, to yield 7 per cent.

Northern States Power Company, St. Paul, Minn.—Sold $1,500,000 first and refunding mortgage 5 per cent bonds.

Public Utilities Company, Evansville, Ind.—National City Company offered $3,000,000 first and refunding mortgage 6 per cent ten-year bonds, dated Jan. 1, 1919, to yield 6.65 per cent.

Richmond (Ind.) Light, Heat & Power Company.—Offers $450,000 two-year 7 per cent notes, guaranteed principal and interest by United Gas & Electric Company of New Jersey, in exchange for outstanding $450,000 notes maturing on March 1, paying holders also 3 per cent in cash.

Toledo Railways & Light Company.—Shareholders authorized issue of $3,200,000 bonds to provide for additions and improvements to electric light and power properties.

Western United Gas & Electric Company.—Emery, Peck & Rockwood, Chicago, offered $500,000 7 per cent debentures.

Wisconsin-Minnesota Light & Power Company.—Offered through Paine, Webber & Company, $1,000,000 one-year 7 per cent notes, dated Feb. 1, 1919, at 99½ and interest.

SOUTHERN COMPANIES

Carolina Power & Light Company, Yadkin River Power Company, Palmetto Power & Light Company.—Spencer Trask & Company and W. C. Langley & Company, New York, offered the first and joint mortgage 6 per cent five-year bonds at 95¾ and interest, yielding over 7 per cent.

Charleston (S. C.) Consolidated Railway & Lighting Company.—Reported to be considering issue of $1,500,000 common stock.

Georgia Railway & Power Company.—Application made to Georgia Railroad Commission for authority to issue $633,000 refunding and improvement mortgage bonds.

Georgia-Alabama Power Company.—Howard R. Taylor & Company, Philadelphia, offered $525,000 two-year 7 per cent collateral trust bonds, dated Feb. 1, 1919, at 99½ and interest.

Pensacola (Fla.) Electric Company.—Stone & Webster offered $500,000 two-year 7 per cent notes, dated Jan. 2, 1919.

FAR WESTERN COMPANIES

Arizona Power Company.—Bonbright & Company, Inc., New York, offered $500,000 bond-secured 7 per cent five-year notes, dated Jan. 1, 1919, at 96 and interest.

Coast Valley Gas & Electric Company, San Francisco.—Applied to California Railroad Commission for authority to issue $125,000 bonds.

Colorado Power Company.—Bonbright & Company, Inc., New York, offered 7 per cent preferred stock.

Great Western Power Company.—A new holding company will issue $6,000,000 first and refunding mortgage 6 per cent bonds and $1,500,000 7 per cent cumulative preferred stock.

Pacific Gas & Electric Company.—Authority given by California Railroad Commission to issue $1,500,000 first preferred 6 per cent stock at not less than 87½ or a like amount of 5 per cent general and refunding mortgage bonds, due Jan. 1, 1942, at not less than 85 and interest. In December $3,500,000 bonds were sold.

Pacific Power & Light Company.—White, Weld & Company and William A. Read & Company offered $1,265,000 first and refunding mortgage 5 per cent bonds, due Aug. 1, 1930, at 89¾ and interest.

San Joaquin Light & Power Corporation, Fresno, Cal.—Application to issue $662,000 bonds reported.

Southern California Edison Company.—Sold through Harris, Forbes & Company, National City Company, E. H. Rollins & Sons and Coffin & Burr, $8,000,000 7 per cent debenture bonds, dated Jan. 15, 1919, and due $1,000,000 annually on Jan. 15 each year, 1921 to 1928, at par and interest; also $8,000,000 general and refunding mortgage 6 per cent bonds at 98 and interest.

Washington Water Power Company.—Offered, through Spokane & Eastern Trust Company, to yield a little over 7 per cent, part of $3,000,000 one-year 6 per cent notes, dated Feb. 2, 1919, balance being used to refund $2,779,000 notes due on Feb. 2, 1919.

Western States Gas & Electric Company.—California Railroad Commission asked to authorize sale of $450,000 5 per cent bonds at not less than 82½ and interest.

CANADIAN COMPANY

Shawinigan Water & Power Company, Shawinigan Falls Que.—Sale of $500,000 stock reported.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

LABOR DATA PERTAINING TO INSTALLATION OF CABLES

Organization of Gangs for Various Types of Installations—Amount of Work Performed and Unit Costs for Various Crossings

BY JOHN D. MORGAN
Mechanical Engineer the Superno Company, Inc.

When electric service companies are called upon to make extensions to their lines on short notice, it is difficult to make accurate estimates of cost because of the rapidly changing market prices. It is thus desirable for engineers to coöperate by making available unit costs on various types of construction. Herewith are presented labor costs of laying submarine cables, with sufficient analysis to make the matter useful to other engineers. The unit costs do not necessarily apply now, but the method of analyzing expenses indicates a way in which old cost data can be applied under changed conditions.

Armored submarine cables can be generally subdivided into the following groups: Transmission cables of 6600 volts to 13,000 volts or higher; distribution cables of 2400 volts, and two, four or one-conductor distribution cables for arc circuits and telephone cables.

In a great many crossings work must be done in order to lower the cables beneath the dredging limits of navigable streams. This work is generally done by contract, and hence no discussion of this factor in submarine cable installation will be given.

The labor of installing submarine cable is generally meant to include the trucking of cable reels to and from the job, setting up reels (except where a scow is used), pulling in cable, anchoring at both ends, splicing at both ends and installing pole lateral.

For convenience is discussing this problem arbitrary classes of construction are made as given below:

Class A —Crossing of 100 ft. to 300 ft.; no scow used.
Class B —Crossing of 300 ft. to 600 ft.; no scow used.
Class C —Crossing of 600 ft. to 950 ft.; no scow used.
Class D —Crossing of 1000 ft.; scow used.
Class D1—Crossing of 10,000 ft.; scow used.
Class E —Crossing of 500 ft.; on bridges.

With this classification in mind, it is seen that gangs will be needed as given in Table I to set up reels (except on scow), install cable and anchor at both ends. These gangs will perform the amount of work, or, in other words, make the number of crossings, shown in Table II.

From Tables I and II the unit cost table given in Table III is obtained.

In general, setting reels on scows will cost about $25, while the trucking of reels will cost as follows:

6600-13,000-volt armored-cable reels, full $25, empty $10; total $35.
2400-volt two and four-conductor cable reels, full $15, empty $5; total $20.
2400-volt one-conductor and other reels, full $2.05, empty $0.83; total $2.88

TABLE I—GANGS FOR 13,200-VOLT AND 2400-VOLT TWO-CONDUCTOR AND THREE-CONDUCTOR CABLES

	A			B and C			D and D1			E		
	No.	Rate per Day	Cost	No.	Rate	Cost	No.	Rate	Cost	No.	Rate	Cost
Foreman	1	$4.50	$4.50	1	$4.50	$4.50	1	$4.50	$4.50	1	$4.50	$4.50
Helpers	8	2.25	18.00	12	2.25	27.00	10	2.25	22.50	8	2.25	18.00
Chauffeur	..	....	.....	1	3.75	3.75	..	....	.....	..	...	.....
Wagon	1	....	6.00	..	Auto	12.00	..	Scow	25.00	..	Wagon	6.00
Boat	1	....	2.00	1	....	2.00	..	Tug	100.00	..	.....	.....
Total,	..	....	$30.50	..	.....	$49.25	..	.....	$152.00	..	....	$28.50

TABLE II—AMOUNT OF WORK PERFORMED BY GANGS IN TABLE I

	A	B	C	D	D1	E
No. of days per crossing	1	1	2	1	3	¼
Crossings per day	1	1	½	1	⅓	4
Feet per day per gang	100–300	300–600	300–475	1000	3333	2000

TABLE III—UNIT COST TABLES

	A	B	C	D	D1	E
Labor cost	$30.50	$49.25	$98.50	$152.00	$456.00	$7.125
10 per cent added for bad weather	3.05	4.93	9.85	15.20	45.60	.713
Total labor cost	$33.55	$54.18	$108.35	$167.20	$501.60	$7.838
Unit cost per foot (cents)	33—11	18—9	18—11.1	16.7	5.02	1.57

NOTE.—For 2400-volt single-conductor arc cables and telephone cables use next cheaper class, or, if already in class A, use 75 per cent of class A cost, or if in class D, use also 75 per cent of class D cost.

TABLE IV—GANG USED FOR SPLICING CABLE

	No.	Rate per Day	Cost
Foreman	1	$5.00	$5.00
Helpers	6	2.25	13.50
Splicers	6	4.50	27.00
Wagon	½ day	.....	1.00
Total	13	.....	$46.50

TABLE V—UNITS PER DAY AND UNIT COSTS PER SPLICE

	Units per Day					
	Four-Conductor, All Sizes	Three-Conductor, All Sizes	Two-Conductor, No. 8 4/0	Two-Conductor, Above 4/0	One-Conductor No. 8 500,000 Circ. Mil.	Eyelet for Pulling
(1) Straight	12	12	24	18	48	42
(2) One-way, two-way	6	6	18	12	24	..
(3) One-way, three-way	6	6	12	12	18	..
(4) More than	6	6	12	12		
	Unit Costs					
(1) Cost of labor	$3.88	$3.88	$1.94	$2.58	$0.97	$1.10
10 per cent for unsettled conditions	0.39	0.39	0.19	0.26	0.10	0.11
Total labor cost	$4.27	$4.27	$2.13	$2.84	$1.07	$1.21
(2) Total labor cost	8.53	8.53	2.84	4.27	2.13	...
(3) Total labor cost	8.53	8.53	4.27	4.27	2.84	....
(4) Total labor cost	8.53	8.53	4.27	4.27	....	....

Table IV shows the gang generally used for splicing cable and Table V the units per day and unit costs per splice.

In a great many cases it is necessary to install a pole lateral at the ends of submarine cable. This item is generally understood to consist of the following operations: Pulling cable up the pole to pot-head location, trucking material, but not connecting at either end. Using these assumptions, Table VI shows the gang needed, units per day done, and unit cost per lateral.

TABLE VI.—GANG NEEDED, UNITS PER DAY AND UNIT COST PER LATERAL

	Gang Needed		
	No.	Rate	Cost
Foreman	1	$4.50	$4.50
Lineman	1	3.25	3.25
Helpers	6	2.25	13.50
Driver	1	3.75	3.75
Auto			12.00
Total			$37.00

	Units per Day	
	13,000-volt three-conductor 2,400-volt, four-conductor	13,000-volt, one-conductor Arc cables 2,400-volt, one-conductor 2,400-volt, two-conductor
No. of laterals per day,	3	4
Unit cost per lateral	$12.33	$9.25
10 per cent for unsettled conditions	1.23	.93
Total labor cost	$13.56	$10.18

In all work or calculations involving labor it must be remembered that figures are subject to wide fluctuations, yet the writer believes that the foregoing figures represent a true weighted average, and that the installation of submarine cables demands the supervision of a man thoroughly versed in the installation of them.

SIZE OF THE GAS FILMS IN MICA INSULATION

May Be Sufficient to Cause Corona When Insulation on Rectangular Conductors Is Not Clamped in Place

Gas films of sufficient thickness to cause corona may occur in insulations, and therefore they must be particularly guarded against. Of the wrapped insulations mica must be particularly watched because its spring-like qualities tend to make it bulge away from rectangular conductors unless clamped in space. The following observations made by G. B. Shanklin and J. J. Matson after conducting some ionization tests are instructive:

Approximation of the stresses in insulation around conductors of rectangular cross-section were made by comparing the voltages at which ionization started with those for a similar sample of round cross-section. The working stresss observed in mica-insulated rectangular-section conductors varied over a considerable range, usually between 7.9 kv. and 17.9 kv. per centimeter. With samples having the insulation clamped to prevent bulging the gas spaces ranged from 0.003 cm. to 0.007 cm. at 100 deg. C. for fresh and aged samples respectively. Without clamping, but with insulation applied with reasonable care to reduce air spaces, their thicknesses were of the order of 0.015 at 25 deg. C. and 0.005 cm. at 102 deg. C. Observations indicated that the higher the voltage rating of insulation on rectangular-section conductors (*i.e.*, the greater the thickness), the more carefully must bulging be guarded against.

RAISE TRANSMISSION VOLTAGE TO MEET GROWING DEMAND

Extension to Longest Line in World, Operating in California, Changed to Y-Connected Grounded-Neutral Circuit

Because of the increasing load on the Imperial Valley line of the Southern Sierras Power Company plans are being made for increasing the voltage of transmission. This line, extending from San Bernardino (at the southern terminus of the main tower line) to Yuma, with a total length of 224 miles (360 km.) was originally designed for operation at 55,000 volts as an isolated system. It is now proposed to change to a "Y" connection of transformers with solidly grounded neutral and operate this line at a potential of 88,000 volts. The conductor, of No. 3/0 aluminum, is of sufficient size to allow this increase without excessive corona loss, and by changing to a "Y" connection it is planned to increase the voltage without increasing the line insulation. A 2000-kva. synchronous condenser at the approximate center of load, some 165 miles (265 km.) from the point of supply, will aid in voltage regulation at the more distant points of delivery.

CORRECT CONDUIT SIZES

Formula by Which the Proper Size of Pipe May Be Determined for Any Combination of Wires

The rubber-covered-wire committee of the Western Association of Electrical Inspectors has called attention to the relation which the total area of the insulated wires in a conduit bears to the inside area of the pipe. From an analysis of the number and size of conductors allowed in conduit by the National Electrical Code, the following limiting conductor areas were obtained in per cent of the inside conduit area: One conductor, 56 per cent; two conductors, 32 per cent; three conductors, 42 per cent; four conductors, 40 per cent, and over four conductors, 37 per cent. These figures have been used successfully on standard wire combinations for years.

The following illustrations will show the method of determining the proper size of conduit where there are combinations of odd sizes of wires. What size of conduit is required for six No. 8 and six No. 2 wires? The area of six No. 8 wires is six times 0.06 in. (0.39 sq.cm.), which equals 0.36 in. (2.32 sq.cm.). The area of six No. 2 wires is six times 0.21 sq.in. (1.35 sq.cm.), which is equal to 1.26 sq.in. (8.03 sq.cm.). The sum of the two combined areas is 1.62 sq.in. (10.45 sq.cm.). According to the table, twelve wires should have an area not greater than 37 per cent of the area of the conduit. The area of the twelve wires in question is 1.62 sq.in. (10.45 sq.cm.), which when divided by 0.37 gives the area of the conduit required. The result is a conduit 4.37 sq.in. (28.2 sq.cm.) in area, and the standard conduit which should be used is 2.5 in. (6.35 cm.) in diameter.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

COMMENDING GOOD WORK INCREASES EFFICIENCY

Idea of Expressing Recognition for Services Well Rendered Can Be Carried Throughout the Entire Organization with Success

"Judicious use of commendation for work well done is a powerful aid in maintaining the spirit and good will of employees as well as in increasing the efficiency and output of any plant," said M. R. Buchanan, speaking before the New Mexico Electrical Association on efficiency of organization, "yet there are men in positions of authority who are blind to the value of this instrument in their hands, if we may judge by their failure to use it.

"The man who is absolutely callous and unresponsive to a word of praise for the performance of a good piece of work has yet to be discovered. Natural modesty may prevent an individual from openly showing that he is pleased, but there is no way by which he can disguise or ignore the warm glow that thrills through him when he hears words of approval.

"No class of worker is immune from the effects of a complimentary remark. The superintendent may wear a silk undershirt and the fireman may cover his torso with red flannel, but beneath the skin they are both human and therefore equally susceptible to the magic of an appreciative look or word. If the board of directors, at the annual meeting, passes a resolution congratulating the superintendent on the showing he has made during the year, he carries that congratulatory letter around in his pocket and shows it to his intimate friends until it becomes worn at the creases and frayed at the edges; moreover, he goes at the work of the new year with an increased determination to improve on his already good record.

"Similarly, if that superintendent pauses on his way through the plant to tell the fireman that he has been right on the job and doing fine work, according to the figures on the daily report sheet, that fireman involuntarily suffers an increase of chest expansion measurable in inches, and the chances are that he goes home and tells his wife that his boss has at last discovered his abilities.

"Recognition—that is the whole matter in a nutshell. To a greater or less degree we all like to attract attention to ourselves or to our achievements. One of the most discouraging and depressing things in the world is indifference. But when to indifference is added routine work of an unattractive and oftentimes laborious nature we have a plausible explanation of the lack of interest and the general low efficiency in many branches of industry.

"There are employers and chiefs who never praise the meritorious efforts of subordinates. Just why they should be so chary of approval is a mystery. If a few well-chosen words of tribute required the spending of money or involved a lowering of prestige or influence, withholding them could be understood; but they cost nothing and their influence is beyond all calculation. To many a man weary with repetition of the same motions and the same round of duties they come like a refreshing breath of air and they act as a pleasing stimulus to better performance.

"There may be excellent reasons why it is impossible to increase the pay of an employee who has accomplished praiseworthy results, but there is no excuse for failure to show recognition of his services when they are unusual in quality or value. More that that, the time to speak the well done is now. If a man deserves praise for what he has produced, let him know it while he can hear the sound of your voice."

FOUNDATION FORCE FOR HOLDING METER DEPARTMENT

This Group of Employees Is Paid Higher Wages—Helpers Paid Smaller Wages, but Not Much Is Expected of Them

A method of holding the meter department of the Cleveland Electric Illuminating Company together was described by J. T. Kermode before a recent meeting of the general meter conference of the Ohio Electric Light Association.

For each division of the work a competent man was selected on the assumption that if these men had the physical ability to work long enough hours they could perform everything required to carry on the operation of a meter department. These men were considered the foundation of the department on which the company could rebuild at a future date. In order to carry out this idea successfully, the pay of all men considered as a part of the foundation was materially increased. Readjustments were then made by lowering the rate of pay for certain classes of work not considered essential in holding the foundation of the department. Men were replaced by women to do clerical work such as making stock-room charges, time reports, meter-testing schedules and meter records, looking after service files, answering customers' inquiries, testing meters in laboratories and such janitor work as was needed in the building. A classification was made of each branch of the work, and a rate of pay was established for each job in connection with the responsibility still imposed in the execution of the work. Thus, if the labor cost to man a meter wagon was $200 per month, the installer receiving $120 and the helper $80, neither man was well paid and consequently both were dissatisfied. Under the conservation policy, the installers were in-

creased to $140 per month and the helpers replaced with young men at $60 per month. Only one out of a certain number of helpers would develop into a good man, it was stated, and therefore a labor turnover among the helpers on meter wagons is expected. The maximum rate to helpers is $60 per month, and except in the cases of those proving exceptionally good no effort is made and no inducements are offered to keep them. By adopting this policy the company is able to pay the foundation of the organization a higher salary without materially increasing the cost of work. In some instances the services of men that could have been used to advantage were lost. However, the company kept sufficient men to hold its foundation for reconstruction at a future period.

ELECTRICAL ADVERTISING SHOULD AGAIN BE PUSHED

Experience of Chicago Lighting Company Points to Profitable Load and to Value of Utility's Itself Using System

BY JOHN F. GILCHRIST
Vice-president Commonwealth Edison Company, Chicago

As the writer sees it, now as never before is the time for the central station to make a determined effort to spread the good cheer of electric light advertising and display. The logic of the situation is almost irresistible. The war is over. The arts of peace are being rehabilitated. The "boys" are coming back to a hearty welcome and to their old jobs or possibly better jobs. The grim necessity of lightless nights is a thing of the past. It is now as much our duty to put the country on the best possible basis of production, of material well-being and good cheer as before the signing of the armistice it was to win the war. In making this tremendous readjustment hardly any other agency can have the same psychological effect as electric light advertising and electric display lighting.

In Chicago we have been doing some newspaper and mail advertising to bring this fact home to the manufacturers, merchants and business men generally, and here are quoted a few sentences:

Brighten up for the boys coming home.

When the boys come home let's have the streets ablaze with cheering light and filled with happy crowds to welcome them.

Electric signs back on the job to help boost your business.

All restrictions off. Use your electric sign to keep trade humming. The brightest stores are the busiest.

Now the war is over and won, Uncle Sam wishes to encourage business expansion along normal pre-war commercial lines.

The booming of the cannon has ceased over there. It is time to boom business over here.

In answer to the questions of what electric sign and other forms of electrical advertising and display lighting mean to a central station and why the use and increase of electric signs should be encouraged, the following tabulation has been prepared from the experience of the Commonwealth Edison Company, giving an estimate of the business of sign and other special outdoor lighting for one year. The figures given are the results of careful estimates, but they are not exact figures and relate to the time before the United States restrictions were in force.

DATA ON ONE YEAR'S SIGN AND SPECIAL OUTDOOR LIGHTING—COMMONWEALTH EDISON COMPANY

	Kw.-Hr. Consumed	Maximum Kw.	Hours' Use
Signs	10,287,000	6,350	4.5
Billboards	953,100	443	6.0
Outline lighting	714,500	442	4.5
Street posts	1,513,300	702	6.0
Exterior brackets	376,100	232	4.5
Total	13,849,000	8,169	4.7

It will be seen from the foregoing that the revenue to be obtained from this class of business is decidedly worth while. In Chicago it is estimated under normal conditions at $850,000 a year. This, too, in spite of the fact that Chicago, from its street arrangement, is not a particular good town for spectacular signs and other large display signs. The number of small signs in use, however, is large. The long-hour characteristics of sign and display lighting speak for themselves. A small part of the sign-lighting load comes on the peak, no doubt, but not enough to make the business undesirable. In the foregoing table street post (curb) lighting is included with other forms of electric light advertising.

Electric sign advertising is good advertising, and this truth should be borne in mind by the central station. The Commonwealth Edison Company has demonstrated this fact by its own experience. It uses electric signs and electric display lighting extensively. On a large proportion of its fifty substations, and also on some of its generating stations, there have been erected rather elaborate roof signs with the best results. These signs are of various design, size and shape, some being as large as 40 ft. wide and 30 ft. high. They all carry the legend "Edison Service" or "Use Edison Service" in letters from 3 ft. to 12 ft. high and accompanied by differing designs, sometimes in colors, representing incandescent blubs with rays or various ornaments and borders, often with flashing effects. The company can trace orders for at least half a dozen big roof signs to this electrical advertising of its own.

In its 1917 report the committee on electrical advertising of the lighting sales bureau of the Commercial Section of the National Electric Light Association makes the point that central stations should as far as possible endeavor to censor the character of signs in its community. By this is meant that the central station, with its excellent opportunities for studying the subject, should use all its influence to bring electrical advertising up to the highest plane possible. The committee criticises, and rightly, the erection of electric signs which in point of design are mere monstrosities. It says, too, that abuses of this character have been responsible for the severe electric signs restrictions that have been adopted by ordinance in many American cities. There is, of course, reason in all things, and the effort should be made to make electric signs, not disfigurements, but rather very decided additions and betterments to the city which they help so greatly to illuminate.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Converter of Three-Phase Into Direct Current.—O. M. CORBINO.—This apparatus is an adaptation of the mercury-jet break in an inert gas, widely used for industrial coils. The fixed plates of the new apparatus, three or six in number, are connected to the terminals of the star-connected secondary windings of an ordinary three-phase or a special transformer. The power obtained can be as high as 10 kw. and the efficiency as high as 97 per cent.—*Science Abstracts, Section B,* Dec. 31, 1918. (Abstracted from *Elettrotecnica,* Oct. 5.)

Recent Developments in Shaft Pressing at Destination.—N. L. REA.—Until recently the task of pressing on shafts at destination has been accomplished by improvised methods, few means, if any, having been provided by the factory. The resulting facilities have often been inadequate, and a great deal of trouble and delay have ensued in many cases. This subject has been fully studied by erection engineers and means have now been developed for performing the operation with precision. The methods that have been found successful are described in this article.—*General Electrical Review,* February, 1919.

Lamps and Lighting

The Tungsten Arc.—O. KRUH.—The author reviews various methods that have been adopted for forming an arc between tungsten electrodes, in some cases one electrode being brought into contact with the other by means of an electromagnet and then withdrawn, in others a third, conical element being interposed by the same means between the electrodes to strike the arc. Ionization methods, involving the heating of a rod composed of suitable alkali-earth oxides, are discussed. The light from the tungsten arc is essentially whiter than that of gas-filled glowlamps; the consumption is stated to be 0.4 watts per candlepower and the intrinsic brilliancy about 40 cp. (Hefner) per square millimeter. The lamp is rich in actinic rays, and the nature of the source lends itself to projection and ultra-microscopic work.—*Science Abstracts, Section B,* Dec. 31, 1918. (Abstracted from *Elektrot. u. Maschinenbau,* Aug. 4, 1918.)

Generation, Transmission and Distribution

Hydraulic Power in the "Massif Central" of France.—P. MORIN.—While the Alpine regions of France have naturally been those most considered in the discussion of hydroelectric installations, other parts of the country also offer great opportunities of this kind. This article discusses at length the water powers of what is known as the "Massif Central," formerly called the central plateau, where two rivers in particular, the Dordogne and the Truyère, are capable of furnishing a great amount of energy. Maps of the river basins and diagrams of the areas drained by the rivers and their tributary streams are printed.—*Revue Générale de l'Electricité,* Feb. 8, 1919.

Lighting Legislation.—H. E. MAHAN.—The Illuminating Engineering Society has given a great deal of attention to the question of legislation regulating lighting in industrial plants, and, after considerable study, a set of requirements has been drafted for presentation to the several state legislatures for their consideration and guidance in enacting laws on the subject. These rules or recommendations are given in this article, and the significance of each is pointed out and discussed.—*General Electric Review,* February, 1919.

Calculation of Short-Circuit Currents in Alternating-Current Systems.—W. W. LEWIS.—The value of being able to calculate short-circuit currents in large power networks, in order to provide and set suitable protective devices, has long been recognized. However, the mathematical methods used in the past for securing the data necessary to this end were laborious and often impossible of application in the more complicated cases. They have nearly all been based on the assumption that the limitation of the short-circuit current is due almost entirely to the inductive reactance of the circuit and that the effect of resistance and capacitance is negligible. The effect of thus neglecting the resistance and capacitance reactance is to give a somewhat larger short-circuit current than would be obtained were they considered. This assumption also greatly simplifies the calculation as, instead of having to add impedances at various phase angles, reactances only need be added and these are all in phase. The author then shows how the short-circuit currents will differ in various parts of a complicated network and that it is desirable to make up what is known as a calculating table for the solution of such problems. By means of the calculating table a miniature representative system is set up and a short circuit placed on it at any point, current being read in any element of the circuit. The author illustrates the method by solving a number of problems.—*General Electric Review,* February, 1919.

Traction

Control of Tramcar Trains.—R. WOLFF.—The safety system of control described is due to the A. E. G. and has been used for trains of tramcars in Dresden during the past year. The use of from one to three trailers is common in many cities owing to the density of traffic at certain hours and the scarcity of labor. Early tests with several coupled motor cars controlled from one point led to cumberson switch, resistance and coupling gears. These defects are overcome by the new equipment, which has been tested on a train of two motor cars (each with its own trolley pole and two 28-kw. motors) and a plain car between them. The weights of the three cars empty and with 142 persons are 33½ tons and 44 tons respectively. The track includes severe gradients and four electrically operated point-setting devices. The motors are controlled on the series-parallel system, and provision is made for isolation of a defective motor. Mechanical design of the equipment and

the principle on which the resistance sections are utilized are such that the control gear is light and compact enough to be fitted to any car. The only connection between the driving platforms is the ten-core control cable. Wiring diagrams are given in the original. Special insulation is provided where required to allow for the fact that when the front and rear cars span section points of the three-wire system there is a potential drop of more than 1000 volts between certain conductors. The experimental train ran 25,000 km. without electrical breakdown or any serious depreciation. Trains of four or more cars may be operated on the same principle. Depreciation of control gear is less and that of motors no higher than in ordinary service. The motors used in the experimental train proved to be unnecessarily powerful, so that no reliable cost data can yet be given.—*Science Abstracts, Section B*, Dec. 31, 1918. (Abstracted from *Elektrot. Zeits.*, Sept. 12, 1918.)

Installations, Systems and Appliances

Control and Safety Devices for Three-Phase Winding Gear.—M. GRAF.—Few hoisting installations of high or medium power have been equipped with simple three-phase motors in the past owing to the violent starting of such machines and their poor flexibility. In spite of the advantages of three-phase motors in other respects, these limitations have led to the use of more costly and complex equipments (Leonard system, three-phase commutator motors, and double Deri motors). The Gewerkschaft Bernsdorf of Hildesheim has had in use for two and one-half years past a winding plant driven by two three-phase induction motors each of 380 hp. (total overload 1175 hp.). The equipment is provided with Brown-Boveri automatic safety devices and is said to be the first installation of its kind. The system is described in considerable detail.—*Science Abstracts, Section B*, Dec. 31, 1918. (Abstracted from *Zeits. Vereines Deutsch. Ing.*, July 13, 1918.)

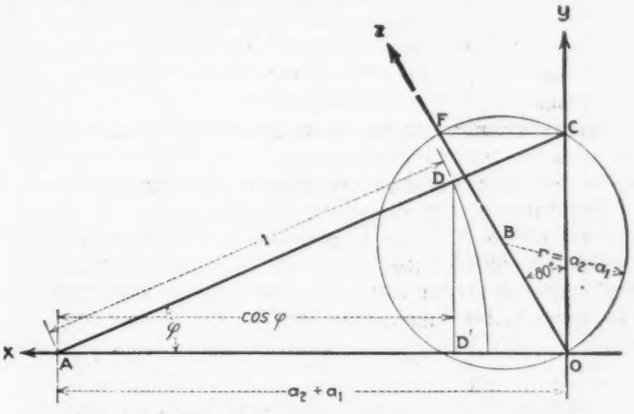
Electric Trucks for Factory Use.—JACQUES DESCHAMPS.—The author describes the various types of small electric trucks, the use of which in French workshops has been greatly increased by the necessities of the war. He gives a brief description of the Edison storage battery and enumerates some of the functions of the trucks. Those now employed in France are of American manufacture.—*Revue Générale de l'Electricité*, Feb. 1, 1919.

Electrophysics and Magnetism

Properties of Electric Circuits of Zero Resistance.—G. LIPPMANN.—A study presented at the January session of the French Academy of Sciences bearing upon this subject, of which the theory received a striking confirmation from the experiments of Kamerlingh Onnes upon superconductors. The author shows that the advantage resulting from the consideration of null resistances is that one arrives at a relation establishing that the general laws of the phenomena of induction are static laws.—*Revue Générale de l'Electricité*, Feb. 1, 1919.

Units, Measurements and Instruments

Graphical Determination of Three-Phase Power Factor.—E. HAIDEGGER.—Assuming symmetrical loading in a symmetrical three-phase system, the power $= \sqrt{3}\ EI \cos \Phi$, and if the two-wattmeter method of measuring power be employed, using instruments with equal constants, then $\tan \Phi = \sqrt{(3)}\ (a_2 - a_1)/(a_2 + a_1)$, where $a_1 a_2$ are the deflections of the wattmeters. A convenient graphical construction for $\cos \Phi$ is shown in the diagram. Between axes OX, OY of the rectangular coordinates draw OZ at 30 deg. to OY. Set out to scale $OA = (a_2 + a_1)$ and $OB = (a_2 - a_1)$. With center B and radius $(a_2 - a_1)$ draw a circle cutting OY in C. Join CA, then the angle $CAO = \Phi$. Set out $AD' = 1$ and drop the perpendicular DD'; then $AD' = \cos \Phi$.



GRAPHICAL DETERMINATION OF POWER FACTOR FROM TWO WATTMETER READINGS

The author gives a proof for this construction.—*Science Abstracts, Section B*, Dec. 31, 1918. (Abstracted from *Elektrot. Zeits.*, Aug. 22, 1918.)

New Method of Measuring High Temperatures.—A. BOUTARIC.—The author expounds the principle of the new method of evaluating high temperatures by means of the coloration of the light emitted by the incandescent body. The method of application is extremely simple, necessitating the use only of a photometer and a lamp previously standardized. Allusion is made to the work of Paterson and Dudding, Hyde, Cady and Forsythe, Pirani and Meyer, Nutting, and Langmuir.—*Revue Générale de l'Electricité*, Feb. 8, 1919.

Amplification Obtainable by the Heterodyne Method of Reception.—G. W. O. HOWE.—Some difference of opinion appears to exist as to the maximum amplification obtainable by the simple heterodyne method of receiving undamped signals. In this paper the author contrasts the Cohen theory that heterodyne amplification can be increased indefinitely by increasing the local current (using an ideal detector of unlimited current-carrying capacity) with the Liebowitz theory that the maximum "true heterodyne amplification" is four. Armstrong's results, obtained with the auto-heterodyne, appear to support the view put forward by Liebowitz (*Abs. 403*, 1917). It is shown by several different methods of considering detector and heterodyne action as compared with chopper detection of received energy that if the detector gives an audibility current proportional to the received current the maximum amplification of audio power is 2.43 and does not increase indefinitely with the local current. With detectors giving an audibility current proportional to the square of the received current — *e. g.*, ordinary contact detectors through a considerable range—the amplification may greatly exceed four, and its excess over four cannot be accounted for on the basis of "increased detector efficiency," since a steady polarizing current will not produce the same increase.—*Science Abstracts, Section 5*, Dec. 31, 1918. (Abstracted from *Proceedings Inst. Radio Eng.*, October, 1918.)

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Coöperative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

ANTENNAS, ELECTRICAL OSCILLATIONS IN.

The mathematical theory of circuits having uniformly distributed electrical characteristics, such as cables, telephone lines and transmission lines, is applied to the oscillations in antennas and inductance coils. Methods have been worked out for determining the frequency of the natural oscillations of an antenna, analytically or graphically, when inductance coils or condensers are inserted in the lead-in. Expressions have been derived which permit the calculation of the effective resistance, inductance and capacity of the antenna, and it has been shown that in so far as frequency or wave-length computations are concerned the simple formula applicable to ordinary circuits with lumped constants gives very accurate results. Experimental methods have been developed for determining the effective and static or low-frequency values of the antenna constants.—*John M. Miller, Bureau of Standards, Washington, D. C.*

HEATER, INDUCTION-TYPE.

A new electric heater of the induction type has been developed which possesses a power factor as high as 95 per cent and whose humming noise, due to transformer action, may be kept quite low. The iron pipe through which the heated water flows forms the transformer core. The secondary winding consists of one turn which is a sheet of copper fitting snugly on the outside of the iron pipe. The primary winding consists of insulated copper wire wound around the secondary—*C. E. Magnusson, University of Washington, Seattle, Wash.*

HYSTERESIS, EFFECT OF CROSS-MAGNETIZING FIELDS UPON.

The effect of an alternating field applied at right angles to the direct field while the hysteresis curve was being traced has been investigated for steel specimens of varying degrees of hardness. The direct field reached a magnitude of 150 gausses, while an alternating field of maximum intensity equal to 80 gausses was applied in some cases. With soft specimens all traces of hysteresis disappeared; with very hard steel the width of the loop was reduced to less than one-tenth of that of the original loop. For soft steel the magnetization curve with the transverse alternating field applied lies almost wholly outside and beneath the normal hysteresis loop. With hard specimens it lies within the normal loop, except near the top, where it passes outside and above it. It is to be observed that the actual magnetizing field at any instant is the vector sum of two fields at right angles, and hence in general it is greater than either component. When the alternating field is applied it is found with hard steel that the longitudinal component of the flux is greater than can be produced by the longitudinal field. This seems to indicate a rotational hysteresis or a tendency for a large flux to maintain its magnitude while it is forced to change its direction.—*N. H. Williams, University of Michigan, Ann Arbor.*

INSTRUMENTS (INDICATING), CRITERION OF PERFORMANCE.

The origin and nature of hysteresis losses in typical instruments and the methods of evaluation have been investigated in detail. This method occupies a field distinct from that of the usual methods of calibration in that it affords a criterion as to the performance of the type rather than as to the errors of an individual instrument, which latter errors are inherently subject to variation of a more accidental character. The investigation will be published in full in the *Journal* of the Franklin Institute.—*Frederick J. Schlink, Bureau of Standards, Washington, D. C.*

MACHINERY, DIRECT-CURRENT, ARMATURE DESIGN DATA.

Analysis shows the armature output to be proportional to the product of the cubical contents, speed, allowable specific electric loading, polar arc, etc. Also, for a given output, polar arc, etc., the armature capacity varies inversely as the cube root of the speed. About ten high-class direct-current dynamos of various sizes and makes from 1 kw. to 10 kw. were tested with due regard to armature dimensions, accepting the name-plate ratings as reasonable, and curves were drawn giving various factors. Other curves prepared from the data show armature length as a function of armature diameter and speed for two-pole and four-pole dynamos with 70 per cent polar arc. Still another family of curves shows allowable watts per square inch of cylindrical surface of armature as a function of capacity and speed. This work ought to be further extended and checked with a considerable number of the very latest machines with confirmed ratings and supplemented by data in terms of various grades and thicknesses of armature laminations in use.—*C. R. Wylie, Detroit, Mich.*

PERMEABILITY, INFLUENCE OF MAGNETIC TREATMENT ON.

An investigation on laminated ring specimens was made by the ballistic galvanometer method. The apparent permeability for a given field strength, plotted against the logarithms of the number of reversals of the measuring field before observation of the galvanometer deflection, gives an "accommodation curve." This curve shows clearly whether the iron is polarized, or demagnetized, and if so whether completely or not, and even indicates any preceding treatment with a field strength *smaller* than that used in measuring. If the iron is polarized, the curve slopes down; if demagnetized, it tends upward toward an asymptote. After an incomplete demagnetization the curve has a maximum, which is reached at a higher number of reversals the more carefully the demagnetization is carried out. This criterion has shown that ninety reversals are entirely insufficient for demagnetization. About 300,000 were necessary for a good demagnetization of a certain sample. Alternating-current and direct-current demagnetization proved to be absolutely equivalent for laminated samples and commercial frequencies, alternating-current being the only one practically useful.—*Edy Velander, Massachusetts Institute of Technology, Boston, Mass.*

RADIO, ANTENNA CONSTANTS.

An accurate determination has been made of the equivalent and true antenna constants for long horizontal aerials. One set of formulas is a logical sequel of the ordinary transmission-line equation and of Dr. Cohen's graphical procedure described in the ELECTRICAL WORLD, Vol. 65, No. 5. The problem may be solved directly with the slide rule. The second new method employs an approximate solution, but the formulas give about the same results as those of the first method. In both procedures the quarter wave-length distribution is considered, and both are in agreement with the actual conditions. A table prepared from experimental data shows the usefulness of the investigation.—*August Hund, Berkeley, Cal.*

RECTIFIERS, ALUMINUM.

Two matters of interest have been investigated that have received scant attention in former publications on this subject, viz., first, the production of voltages higher than those usually obtained and, second, the wave form of the rectified current. Forty lead-aluminum cells were used grouped with ten cells in series in place of each of the four elements of the Nodon valve arrangement. A rectified voltage having a maximum value of more than 3000 volts was thu sobtained, the r.m.s. value being 2600 volts. The wave forms were determined by means of the oscillograph. The current curve for all loads lies entirely upon one side of the zero axis. When the load is non-inductive, the voltage also is unidirectional, but with an inductive load the voltage curve shows small negative values at the minimum points. By graphical differentiation of the current curve the emf. due to self-induction may be determined. It is found that the ordinates of this curve account satisfactorily for the difference between the voltages when the load is inductive and when it is non-inductive. Efforts to obtain currents with as little fluctuation as possible were made by putting inductance into the load circuit and a condenser in parallel with the load. In some cases it has been possible to reduce the fluctuations of the rectified current from its mean value to a trifle over 1 per cent.—*N. H. Williams and J. M. Cork, University of Michigan, Ann Arbor.*

Suggestions for Research

CONTACTS, OXIDATION OF.

It is very desirable to understand the limitations in the design of circuit breakers, contactors, switches, etc., caused by oxidation on contacts. There is no question that the circuit-breaker contacts will increase in temperature quite rapidly under certain conditions. It is questionable whether contactors would show the same effect. This may be due (a) to the contactors being small and the circuit breakers large, (b) to a difference in design which produces a different action on the contact, (c) to trouble caused by something entirely apart from oxidation. This problem could be handled experimentally in an ordinary laboratory if the investigation were confined to comparatively small values of current. It is a very important subject to understand, as it is the basis for the limiting temperatures on many forms of contacts.—*H. D. James, Pittsburgh, Pa.*

FUSES FOR DIRECT-CURRENT LOCOMOTIVES.

A fuse adapted for a 3500-volt direct-current circuit, which shall be small enough to be placed in a locomotive cab and reliable enough adequately to protect circuits whose normal current is from 5 amp. to 500 amp.—*Capt. Chester Lichtenberg, Washington, D. C.*

IMPEDANCE, MUTUAL.

While this term, as applied to telephone circuits, has been defined in the A. I. E. E. Standardization Rules, it is desired that a general mathematical expression be worked out similar to the formula for ordinary impedance, to avoid confusion in applications.—*Editorial Suggestion.*

INSTRUMENT TRANSFORMERS, EFFECT OF OVERLOADS.

It is a well-known fact that the indicating errors of a current transformer are widely changed if its magnetic circuit is accidentally overloaded. This is due to polarization effects, which constitute aperfectly definite ferro-magnetic phenomenon and have been studied from a physical point of view. It would be of great interest to obtain quantitative data on actual instrument transformers, showing the changes in ratio and phase error after heavy short circuits. These errors, indeed, must be expected whenever the measured current drops suddenly from a higher value to a lower. Such data would enable one to develop some standard process of demagnetization and would help to settle some other equally important practical and theoretical questions.—*Edy Velander, Massachusetts Institute of Technology, Boston.*

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

ELIMINATION OF STATIC IN RADIO COMMUNICATION

Roy A. Weagant Explains Method by Which He Has Been Able to Avoid Disturbances — Makes Radio More Reliable

The invention of Roy A. Weagant, chief engineer of the Marconi Telegraph Company, which was announced several months ago as a device that would completely eliminate the so-called static interference of radio signals, was explained in full last week at a joint meeting of the Institute of Radio Engineers and the New York Electrical Society. About 500 persons were present.

In general the solution is based almost wholly on the discovery that the static waves which cause the most trouble are propagated vertically with respect to the earth's surface whereas signaling waves move horizontally. This difference made it possible to eliminate interference from the "grinders," as they are called, by placing two low rectangular loops in the same vertical plane but at the same elevation. The static waves, moving vertically, reach both loops simultaneously, whereas the signal waves, traveling horizontally from a given direction, set in vibration, first, the loop which is nearest to the sending station and afterward the second loop.

As a result the currents set up in the two loops by the static disturbance are in phase and may be canceled by proper connection of the loops. On the other hand, the currents set up by the signal waves will be out of phase by an amount depending on the sending wave length and the distance that the loops are apart horizontally. By placing them exactly one-half wave length apart a phase difference of 180 deg. will be obtained, but these currents can be made to add arithmetically by proper connection of the loops, so they really strengthen the signal received.

Another advantage of Mr. Weagant's method is that costly towers, which are required with high antennas, are eliminated. Experiments were mentioned by the investigator in which he was able to obtain very satisfactory results with antennas laid on the ground or slightly buried, provided that the length was not too great.

While the foregoing method eliminated "grinders," it did not reduce the disturbance from "clicks." Investigation indicated that the static waves producing these disturbances follow no definite direction but seem to come from all azimuthal points. Of the many methods tried to eliminate these "clicks" one using three loops was most satisfactory. Two of the loops were placed as in eliminating "grinders," while the third loop was placed between. The connections were made in such a way that the currents produced in one set of loops by the second kind of static could be used to cancel those produced by the same cause in the other set of loops, leaving the signaling current free of disturbances.

These methods of eliminating static disturbances are not merely theoretical schemes but devices which have actually been tested on a commercial scale in a number of places and under very severe conditions by Mr. Weagant. By these methods he has been able to maintain undisturbed communication with European stations during summer months and in the afternoon when disturbances are the worst. Furthermore, he has been able to screen out interference from neighboring stations rated as high as 200 kw., provided that they are not in the direction of the sending stations—this by changing the directional-sensitivity characteristics, which can be easily done with three loops.

While much of the investigation work conducted by Mr. Weagant was done with aerials as long as 6 miles, he stated that he has been able to receive transatlantic messages with antennas which can be set up in an average-sized room, provided that amplifiers are used.

Several men noted in radio circles took part in the discussion which followed the presentation of the paper, among them being Prof. M. I. Pupin, Dr. A. N. Goldsmith, G. H. Clark, David Saranoff, E. F. Alexanderson and F. N. Waterman. All hailed Mr. Weagant's investigation as an epoch-making accomplishment. It has placed transatlantic radio-telegraphy on a competitive basis with cable telegraphy because of its greater speed and smaller expense. Furthermore, the great barrier in the way of practical radio-telephony has been removed and transatlantic radio-telephony brought much nearer. When this is effected it will revolutionize international relations in the same way as the telephone has revolutionized business relations in this country. Another feature of Mr. Weagant's investigation is that he has discovered a new law of nature that static waves producing "grinders" are vertically propagated.

The value of amplifiers in radio work was also emphatically brought out, their use and the manipulation of phase differences being two distinct steps in recent radio development.

LAUNCHES CAMPAIGN TO "ELECTRIFY YOUR HOME"

Meeting Called by Society of Electrical Development in New York This Week Decides to Make Effort for April 1 to May 15 Demand

At a meeting called by the Society of Electrical Development in New York on Wednesday of this week it was decided to launch an "Electrify your home" campaign. The slogan will be "Electrify your home for convenience, comfort, efficiency and economy." From Apirl 1 to May 15 is the date. Circulars, posters, etc., to those specially interested will be sent out by the society.

Census Bureau Report of Electric Light and Power Stations—1917

Preliminary figures, published herewith, of the forthcoming quinquennial report on the central electric light and power stations of several states have been given out by Director S. L. Rogers of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of Eugene F. Hartley.

The statistics cover both commercial and municipal plants. They do not cover electrical plants operated by factories, hotels, etc., which generate for their own consumption, those operated by the federal government and state institutions, and those that were idle or in course of construction.

	New York			California			Kansas		
	1917	1912	Per Cent of Increase * 1912 to 1917	1917	1912	Per Cent of Increase * 1912 to 1917	1917	1912	Per Cent of Increase * 1912 to 1917
Number of establishments	332	321	3.4	98	112	—12.5	302	176	58.6
Commercial	277	272	1.8	79	97	....	116	94	.....
Municipal	55	49	.....	19	15	.....	186	82	.....
Income	$84,716,578	$57,218,973	48.1	†$40,277,613	†$27,685,573	45.5	‡$6,954,518	‡$3,020,154	130.3
Electric service	$79,831,241	$53,189,000	50.1	$38,768,970	$26,461,154	46.5	$6,733,688	$2,909,012	131.5
All other	$4,885,337	$4,029,973	21.2	$1,508,643	$1,224,419	23.2	$220,830	$111,142	98.7
Total expenses, including salaries and wages	$67,251,033	$44,297,869	51.8	$32,705,192	$22,803,526	43.4	$6,014,633	$2,626,270	129.0
Number of persons employed	16,251	13,733	18.3	6,167	5,738	7.5	1,775	1,109	60.1
Salaries and wages	$15,315,788	$11,034,898	38.8	$7,132,056	$5,823,203	22.5	$1,409,778	$787,189	79.1
Total horsepower	1,753,191	1,157,809	51.4	1,181,394	848,248	39.3	207,854	98,328	111.4
Steam engines:									
Number	488	553	-11.8	122	169	-27.8	209	192	8.9
Horsepower	1,052,345	638,932	64.7	450,180	414,206	8.7	167,885	82,372	103.8
Internal-combustion engines:									
Number	70	66	....	11	11	....	275	103	167.0
Horsepower	5,948	6,471	—8.1	2,237	1,980	13.0	21,965	7,136	207.8
Waterwheels:									
Number	42	405	4.0	224	205	9.3	34	26	
Horsepower	694,898	512,406	35.6	728,977	432,062	68.7	18,004	8,820	104.1
Kilowatt capacity of dynamos	1,211,904	772,030	57.0	816,974	588,281	38.9	143,274	69,205	107.0
Output of stations, kilowatt-hours	3,828,592,184	2,175,048,634	76.0	2,746,567,337	1,747,459,041	57.2	269,983,648	133,252,988	102.6
Stationary motors served:									
Number	62,181	82,525	—24.7	21,480	29,059	—26.1	7,253	5,021	44.4
Horsepower	1,193,264	795,256	50.0	1,410,271	603,742	133.6	121,259	33,277	264.4
Number of street lamps:									
Arc	20,373	47,391	—57.0	13,738	19,341	—29.0	2,666	3,933	—32.2
Incandescent, etc	156,940	62,706	150.3	108,781	75,802	43.5	35,170	14,573	141.3

* A minus sign (—) denotes decrease. Per cent not computed where base is less than 100.
† Exclusive of $107,617 in 1917 and $75,817 in 1912, reported by street and electric railway companies as income from sale of electric energy.
‡ Exclusive of $518,326 in 1917 and $283,522 in 1912, reported by street and electric railway companies as income from sale of electric energy.

SUPPLY JOBBERS OF THE ATLANTIC DIVISION MEET

Generally Stated that Business in First Two Months of 1919 Surpassed Same Period in 1918—Excess Supplies of Government Electrical Goods

A well-attended meeting of the Atlantic division of the Electrical Supply Jobbers' Association was held on Tuesday at the Hotel Commodore, New York City. Reports of the publicity, war service, lamp and appliance committees were read and the several geographical sections of the division made reports on the local business conditions. It was generally stated that business for the first two months of the current year surpassed that for the similar period of 1918. The new taxes on automobile supplies, portable electric fans and portable electric lamps were discussed, but no decision relative to a method of payment was reached.

At the morning session Ainslie A. Gray, the advertising counselor for the association, outlined the plans for conducting the association's jobber publicity campaign. W. E. Robertson of Buffalo, in telling of postwar activities of the jobbers' war service committee, stated that the committee will send to all certificated jobbers for signature a form giving to the committee power of attorney to purchase surplus government electrical goods, the price to be at the committee's discretion.

These goods will then be distributed among those houses for which the power of attorney was received. In this way the jobbers expect to prevent the demoralization of the market which might follow should the goods find an outlet through the usual channels of the electrical trade.

W. T. Bickford of the Iron City Electric Company, Pittsburgh, Pa., was elected chairman of the Atlantic division for the ensuing year.

PROBLEM OF EFFICIENT OPERATION IS NOW FIRST

Time for Output at Any Cost Has Passed, Say Members of Station Operating Committee of Ohio Electric Light Association

The time for output at any cost has passed, and the problems of efficient operation must now be given first consideration, according to the members of the station-operating committee of the Ohio Electric Light Association, which met at Youngstown, Ohio, on Wednesday of this week. Prof. Henry B. Dates of the Case School of Applied Science, chairman of the committee, presided, and Walter N. Polakov, consulting engineer of New York, made the principal address to about sixty engineers on the subject of cheaper power as a reconstruction problem.

In the course of his remarks Mr. Polakov said that inefficient operation is tolerated in many power plants to-day because economy and efficiency are expected from the perfection of equipment without the proper consideration being given to the manner in which it is used. Engineers owe it to their country to use its power-producing equipment in such a way that the greatest amount of power will be generated at the lowest possible cost. It will require a scientific study of processes and an analysis of all losses to accomplish this, and the results cannot be kept up to the desired standard without an efficient organization.

The audience was advised to pay special attention to boiler rooms because the greater economies can usually be made there. Instruments were advocated in boiler rooms, in order to guide the men in adjusting the condition of combustion to the requirements of the load. Some incentive, preferably a bonus, was advocated for firemen and also for as many other employees as can be given definite tasks. Seventy per cent boiler efficiency was suggested as the point in many plants where the firemen's bonus may be started with advantage. Twelve-hour watches were condemned from the standpoint of efficiency.

The speaker read letters from plant operators who testified that the change from twelve-hour to eight-hour shifts saved them enough in coal more than to offset the additional 50 per cent in wages. The eight-hour shift was also said to have attracted a better class of men and to have made better service possible.

The discussion which followed showed a general agreement on the part of those present with the salient points brought out by the speaker. Among those who contributed to the discussion were R. T. Sullivan, O. H. Hutchins, E. H. Biel, J. Dolan, H. W. Bromley, W. Long, J. B. Lindsay, A. Schellman and A Kirby.

A two-phase electric furnace which melts brass with but one-third the spelter loss of present fuel-fired furnaces was described by Edgar F. Collins, industrial heating engineer for the General Electric Company, Schenectady, in a paper entitled "Melting Some Nonferrous Metals in an Electric Furnace." The paper was read at Cleveland on March 11, before about 200 members and guests of the Cleveland Engineering Society.

CENTRAL DIVISION JOBBERS ON GOVERNMENT SUPPLIES

Federal Government Method of Dealing with Existing Installations or Warehouse Stocks Arouses Comment at Meeting in Chicago

Meeting in Chicago on Wednesday of this week, the central division of the Electrical Supply Jobbers' Association discussed the government's method of dealing with electrical supplies on hand either in the form of existing installations or in the form of stocks in warehouses.

Franklin Overbagh, general secretary of the Electrical Supply Jobbers' Association, stated that he had a letter from the government authorities to the effect that no materials owned by the government would be disposed of in such a manner as to disrupt market conditions. This statement promptly brought forth reports concerning several specific sales of government materials in a manner which decidedly disrupted market conditions.

Other topics which were discussed at the meeting included the future plans for collecting more statistics on the jobbing business and the publicity campaign of the Electrical Supply Jobbers' Association.

Mr. Van Winkle of the publicity committee reported progress and called for criticisms of the advertising. There was practically no adverse comment from the jobbers on the campaign, but all seemed to realize the necessity of tying in their own sales and the executive efforts with the campaign in order that each individual jobber might get the maximum advantage from the $12,000 expenditure which the association has authorized for 1919. It was suggested that, while copy for the advertising is to be prepared by A. A. Gray of Chicago, the committee would welcome suggestions from the members as to probable copy appeals that would be likely to interest the readers of trade papers in which the jobbers' advertisements are being run. One idea which the committee will probably adopt in order to assure more widespread attention to the campaign is that of calling attention to the campaign on the letterheads of each of the individual association members. Mr. Gray spoke briefly about the scope of the plan.

The salaries and expenses of salesmen for country, city and store work and also of clerical workers were discussed, and statistics were shown from sixteen jobbing houses. The averages taken from these statistics indicated that the lower-priced help received greater percentages of increases than others. Statistics on volume of business done by the sixteen jobbers showed a decrease of approximately 3 per cent for 1918 over 1917. The operating expenses increased more than 7 per cent in the same period.

The discussion of the general business situation indicated that jobbers are having no difficulty in securing stocks and that good business for 1919 is expected. Especially in the agricultural districts is the outlook bright. In the last half of the year building of a general character is expected to be brisk. Many small line extensions are to be built. These facts, together with the knowledge that money is plentiful, are making the jobbers optimistic.

There was some discussion as to the advisability of figuring income tax, which last year amounted to about 2 per cent of the gross business of jobbers, as an item entering under the expense of doing business.

As the result of a communication from W. R. Herstein of Memphis, the general secretary was instructed to take up with the National Board of Fire Underwriters the possibility of substituting No. 12 wire as the approved size instead of No. 14 wire in residential work on account of the very marked tendency on the part of residential electric service users to overload circuits with socket devices.

W. R. Herstein of Memphis was elected chairman for the central division.

WAGE AGREEMENT AT LYNN GENERAL ELECTRIC WORKS

Work of the Joint Committee and Conference Board Ends Long-Standing Controversy— Back Pay for Employees

The joint committee and conference board which has been sitting for several weeks upon the questions of wages and working conditions at the Lynn (Mass.) Works of the General Electric Company reached an agreement March 6, ending a controversy between the company and its employees which began July 17, 1918. The employees will receive back pay to the amount of about $[illegible]00,000, the agreements having been made in accordance with an award of the War Labor Board issued Oct. 24, 1918. The conference board, officially designated as the general joint committee on adjustment, consists of four representatives of the employees and four representatives of the management. Harland A. Perkins, examiner of the War Labor Board, who has been at Lynn for several weeks, sat with the conference board.

NEW PLAN OF PROCEDURE FOR N. F. P. A. ELECTRICAL COMMITTEE

Adoption of Method for Discussions of Code Rules and the Preparation of Future Editions of the Code — Details of the Plan

The electrical committee of the National Fire Protection Association, which has charge of the National Electrical Code, at a meeting held in New York on March 4 and 5, adopted a new procedure for discussions of code rules and for the preparation of future editions of the code.

The purposes aimed at are to provide an established methods of dealing with proposed changes, secure their early and deliberate consideration by all who are concerned with code affairs and encourage and provide for a more orderly participation than heretofore in investigations and recommendations for changes in the rules by the various associations having representatives on the committee and all others in any way interested.

The plan in general includes the division of the electrical committee into standing committees having charge of groups of subjects and the general supervision of the work of technical sub-committees which will report to them. Each standing committee is charged with the duty of advising all associations, companies or individuals especially interested in the topics supervised by the committee of items under consideration and inviting comments, criticism and assistance.

The bulletin issued by the electrical committee just before each of its biennial meetings for revising the code will consist chiefly, if not wholly, of the reports and recommendations of these standing committees. It is hoped and intended that such reports shall be so fully discussed before the bulletin is issued that they will have been well understood and their recommendations have been quite generally indorsed by all those who are most concerned with them and who are best qualified to judge of them.

It is evident that the success of this method will depend not only on the work of the standing committees but quite as much upon the coöperation of other organizations and individuals. This coöperation the electrical committee earnestly desires and solicits.

Before final action is taken by the electrical committee on a new edition of the code a public hearing is to be held for the discussion of standing committee reports and such other matters as an advisory committee may recommend for consideration. The final action on the code will be taken after the public hearing and with due regard to evidence and opinions developed by it.

The standing committees are to be assigned charge of the following ten general groups of subjects:

Grounding rules.
Industrial applications.
Cars and railways.
Devices and materials.
Outside wiring, building supplies and services.
Wiring standards and systems.
Generating stations and substations.
Theaters, moving-picture establishments, garages and other special buildings.
Lamps, fixtures, heaters and signs.
Signal systems.

The personnel of these committees will be announced shortly.

All suggestions for changes in the next edition of the code (that of 1920) should be sent as soon as possible to Dana Pierce, chairman of electrical committee, N. F. P. A., 25 City Hall Place, New York.

The formal statement of the new procedure as adopted by the committee is as follows:

Committees.—Except as expressly directed by the electrical committee as a whole, the work of investigation and reports on technical and engineering subjects affecting the National Electrical Code shall be conducted by and through two classes of committees, to be known as standing committees and technical sub-committees.

The appointment of such committees is not intended by the electrical committee to establish any hard and fast limitations of responsibility or of authority or to restrict in any manner the interest or activity either of any member of the committee itself or of any coöperating association or individual, and it is expected and intended that the work of committees will, as heretofore, be assisted and supplemented by others through general and deliberate discussion of all changes and revisions of the National Electrical Code.

Standing Committees.—(1) Standing committees shall be appointed to receive suggestions, initiate action and organize investigations. They shall invite opinions and statements of experience from associations, bureaus, organizations and individuals interested in subjects under consideration by the electrical committee for the betterment of the National Electrical Code.

(2) Standing committees shall be composed of members of the electrical committee and shall be appointed by the chairman.

(3) The duties of a standing committee shall be:

(a) To act as advisers to the electrical committee and its technical sub-committees on the most suitable and appropriate methods of relating the work of the electrical committee to that of associations, bureaus and other organizations, both those represented on the electrical committee and also others interested in or affected by the committee's work.

(b) To advise the chairman of the electrical committee of topics which should receive consideration.

(c) To receive from technical sub-committees reports as prepared from time to time, referring these to other associations as may be desirable for concurrence, criticism or suggested changes in advance of final recommendation to the electrical committee.

(d) To render to the electrical committee reports on all matters referred to it. Such reports may contain recommendations for or against changes in the National Electrical Code and shall indicate which portions of the report should properly be included in the bulletin. All reports to be acted on at the regular biennial meetings of the electrical committee shall be filed by the standing committees with the secretary on or before the first of December preceding such biennial meeting, except that by vote of the advisory committee reports filed at a later date may be presented at the public hearing and subsequently acted upon by the electrical committee.

Technical Sub-Committees.—Technical sub-committees shall be appointed by the chairman of the electrical committee either as judged necessary by him or by direction of the electrical committee or upon the recommendation of a standing committee.

Technical sub-committees shall be composed either of members of the electrical committee or of other persons, or both.

The chairmen of technical sub-committees shall be designated by the chairman of the electrical committee.

Topic or topics to be dealt with by each technical sub-committee shall in general be designated by the chairman of the electrical committee, but other related topics or phases may be acted upon and reported.

Upon the appointment of each technical sub-committee, its chairman shall be advised with which standing committee he shall confer and to which he shall report. He shall as promptly as possible advise both the members of his sub-committee and of the designated standing committee of the nature and scope of the subjects to be acted upon and invite their active coöperation.

Advisory Committee.—There shall be an advisory committee consisting of the chairman and secretary of the electrical committee and the chairmen of the standing committees.

The advisory committee shall hold a meeting shortly before the public hearing, at which it shall determine which committee reports and other recommendations and suggestions received too late for publication shall be presented for consideration at the public hearing and for subsequent action by the electrical committee.

Procedure for Public Hearings.—The meetings of the electrical committee for revision of the National Electrical Code will ordinarily be held between the first and the fifteenth of March every other year.

Prior to a meeting of the electrical committee at which final action is to be taken on the next edition of the National Electrical Code a public hearing shall be held.

In advance of a public hearing the secretary shall prepare and issue a bulletin of the subjects to be considered. This bulletin shall contain reports and recommendations from the standing committees and from the electrical committee as a whole.

Reports, recommendations or suggestions received from standing committees or from other sources too late for inclusion in the bulletin may be considered at the public hearing upon the recommendation of the advisory committee.

Votes taken at a public hearing shall be recorded as expressing the sense of the meeting.

After the public hearing the electrical committee will consider and act on all reports, recommendations and suggestions for the next revision of the code.

SAYS HIGH PRICES HAMPER GROWTH OF EXPORT TRADE

President Herr of Westinghouse Electric & Manufacturing Company Advocates Vigorous Effort to Lower Electrical Machinery Prices to Foreign Level

In outlining the steps which American manufacturers must take to hold their foreign trade, E. M. Herr, president of the Westinghouse Electric & Manufacturing Company and a director in the American Manufacturers' Export Association, declares that reductions in high wages accompanied by a reduction of prices are essential.

"The development of export business in electrical machinery, under the present condition of export markets," said Mr. Herr, "would be very rapid and of unusual extent were it not for the high prices which must now be charged for this product. There are some countries which, owing to the ravages of war and the necessity of first remedying the most serious destructive effects of this strife, cannot immediately take up the development of peaceful pursuits. It is in this that electrical machinery finds its legitimate field.

"The most vigorous effort should be made by those engaged in the manufacture of electrical machinery to bring prices to a point approximating those obtained for this material in foreign countries, as with the domestic market slowing down, owing to the transition from war to peace conditions, the present time is particularly advantageous for the development of the export field. It is encouraging to note important decreases in the cost of a few of our raw materials, and if some yielding of the very high labor costs can also be obtained, we should very soon find an expansion of the export demand for electrical machinery that would more than compensate labor for any sacrifices in hourly rates by the longer hours and more continuous employment which would result.

"In the industrial countries of the world the enormous increase in demand for manufactured products caused by the war has shown the great need for and advantage in the use of electrical machinery, making these countries particularly keen to avail themselves of the economies and advantages of electrical power. This is especially true in countries where fuel is scarce and expensive and where water power is available. Plans are already well matured for the development of larger central electrical power stations in some of the most important industrial countries, and extensive projects for the electrification of some of their railroads are well under way. The smaller and less economical steam plants will in this way be displaced by larger and more economical ones and the demand for transmission and energy-consuming devices be greatly enlarged.

"The largest electrical manufacturing companies abroad are in Germany, and it will be some time before they can operate advantageously. This will give the American companies an unusual opportunity, if promptly seized, of bringing our exports of electrical machinery to an amount and value which is not possible under normal conditions.

"If this situation is found in the industrial countries of the world, what is the prospect for export business in the class of product under discussion in the non-industrial countries? These countries not having been at war, the advantage of electrical machinery and the development of electrical power is not so insistent, so that the market for these products will develop more slowly.

"Countries such as South America, South Africa, Australia, India and China have been dependent upon Europe for their supply of capital and the financial arrangements, credits for loans, etc., were made in London, Paris or Berlin. America is now the great creditor nation, and unless we arrange to invest our capital in these countries and in the industrial countries also but to a lesser degree, we cannot command our fair share of their export trade even though our prices are competitive.

"Before the war we did a comparatively small part of the business of furnishing foreign countries electrical machinery, but we will not keep even this small part of the business long—though we should succeed in securing a great many orders while Europe is prostrated—unless we invest our money there, arrange ample credit facilities and send our well-trained young men to those lands, not to make a business trip or excursion, however complete or extended, but to settle down and make their homes in such countries, learning the needs and tastes of these people, not by casual observation but by intimate, friendly and long-continued personal and sympathetic contact.

"We should never forget in any industrial business that we are selling service as well as product and that, however good the quality of one's product, if the material does not come when needed, is not packed properly or in any other way our service to the customer is unsatisfactory, the transaction fails to tend to tie him to the producer and permits a competitor to obtain a foothold not otherwise possible."

In order to bring about better coördination of the various government agencies directly or indirectly concerned with foreign trade matters, the American Manufacturers' Export Association has expressed itself as in favor of a closer and more definite union of these agencies under some control board or commission.

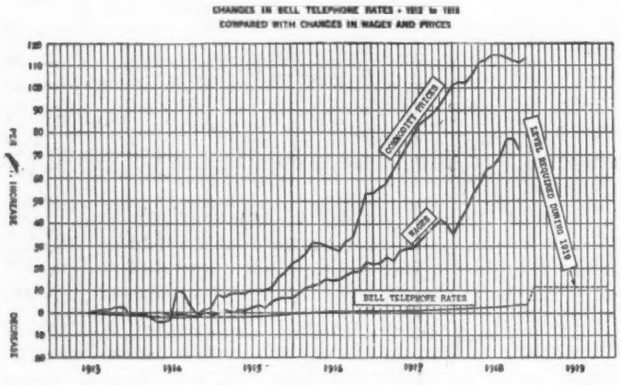
POSITION OF THE TELEPHONE DURING AND AFTER THE WAR

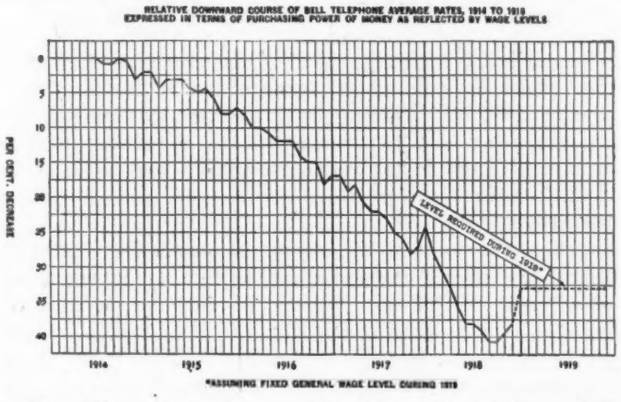
President Vail of American Telephone & Telegraph Company Reports on Operations of Bell System and the Present Outlook

In reporting to stockholders of the American Telephone & Telegraph Company for 1918, President Theodore N. Vail devotes most of his usual interesting discussion to matters connected with the war and to questions arising from the new relations involved in government operation of the properties.

Except for 1906 and 1912 the net amount of plant additions in 1918, $77,922,600, was the largest since 1900. It was distributed as follows: Real estate, $10,066,038; equipment, $30,558,721; exchange lines, $21,713,369; toll lines, $19,894,646. There was a decrease in construction work in progress, etc., of $4,310,143, leaving a total increase of $77,922,631.

Mr. Vail speaks of the difficulty of maintaining standards, of meeting the increasing demands of service and of maintaining a full complement of employees. "Altogether, exclusive of employees of the Western Electric Company, Inc., about 14,000 of our employees entered service." He adds: "Of our highly educated scientific staff in our highly technical departments, over 15 per cent were taken into special service, while of our highly skilled expert staff, trained and educated in the art, over 20 per cent were taken into special or active service. The great increase in the openings for women in all kinds of work, although from its very nature temporary, together with greatly increased compensation far above that which the telephone revenue would warrant, attracted many of our operators and made serious inroads on our operating force."




RELATIVE DOWNWARD COURSE OF BELL TELEPHONE AVERAGE RATES, 1914 TO 1919
EXPRESSED IN TERMS OF PURCHASING POWER OF MONEY AS REFLECTED BY WAGE LEVELS
PER CENT. DECREASE
LEVEL REQUIRED DURING 1919*
1914
1915
1916
1917
1918
1919
*ASSUMING FIXED GENERAL WAGE LEVEL DURING 1919

In speaking of the natural disturbance in the change to government control, accompanied as it was by rumors from irresponsible people, Mr. Vail says: "This cause of disturbance and uncertainty should be completely quieted by the continuance of existing operating organizations under the operating board of the Postmaster General, and also by the full realization that all who are capable, efficient and interested in the work are now needed even more than in the past for the proper carrying on of a service that must be continued at the highest possible standard of usefulness and efficiency."

Referring to government control Mr. Vail says that this "is in no sense permanent nor can it be likened to a sale and purchase. It is very temporary in its nature, for the property is to be returned after a limited period. The necessity of ample time to prepare for common supervision of operations was recognized and cared for in the order of the President, which continued temporarily the operation in the hands of the existing organizations.

"It seemed as if there was above the respective interests of either the government or the Bell system a common 'super-interest,' an obligation and responsibility resting upon both, in the preservation of a high standard of the plant, equipment and organization necessary to the maintenance of the service to be rendered to the public. The Post Office Department could not but be vitally interested in maintaining the service up to the past standards or better, and to do that the plant, equipment and operating organization must be maintained. The Bell system was interested, if the plant and organization were to be returned at the end of the period of control, in having them returned in at least as good condition as when taken over. If the system was to be retained permanently, through subsequent legislation, the Bell system wanted no depreciated plant upon which the valuation would be based."

Much attention to the matter of increased rates is given, and this statement is made in the report: "The increases in the telephone charges have been about 4 per cent, and the increases which have been asked for and which are necessary to preserve the equilibrium of revenue and expenses would amount to less than 13 per cent, which compared to increases in all other commodities is almost negligible."

Concluding his presentation of conditions, Mr. Vail discusses combination and regulation. His observations follow in part:

It will be extremely unfortunate if with a very pronounced public sentiment in favor of it a wire system with nation-wide, universal, comprehensive service and complete utilization of all the facilities cannot be evolved from the existing conditions.

The era of small capital and great expectations in utilities of necessity is passed. The era of large possibilities and large investment capital is here. The incentive of large accomplishment must now control and this requires large capital. The only incentive to capital in large amounts is certainty and security, and certainty and security can only come through responsible control and regulation recognizing economic rules or laws deduced from experience, judicial in its conclusions, equitable in its findings, prompt in its action, and, above all, the controlling and regulating bodies to be of such standing and such authority, either moral, legal or personal, as will give effect to or command respect for their decisions.

Control and regulation should be divorced as far as possible from partisan or class influence, and the influence of misinformed or interested public prejudice. It is impossible for any body to be judicial or equitable if its decisions are subject to hostile criticism and public condemnation without any other reason than prejudice based on misinformation or ignorance.

PLAN FOR ORGANIZATION OF AMERICAN WELDING SOCIETY

First Meeting to Be Held in New York on March 28—Relation to Existing Organizations and the American Engineering Standards Committee

During his presidential address at the midwinter convention of the American Institute of Electrical Engineers in New York on Feb. 19 to 21 Prof. Comfort A. Adams spoke of a plan to form a welding society. Details of this plan have just been made public by the American Welding Society (temporary association) through H. C. Forbes, secretary, Engineering Societies Building, New York.

This society will merge the welding committee of the Emergency Fleet Corporation and the National Welding Council and will include others who may be interested. It is the purpose of the society to become a disinterested and dependable source of information on welding, not only for the benefit of the manufacturers of welding apparatus and supplies but also to aid those who use welding in their production and those who purchase welded goods.

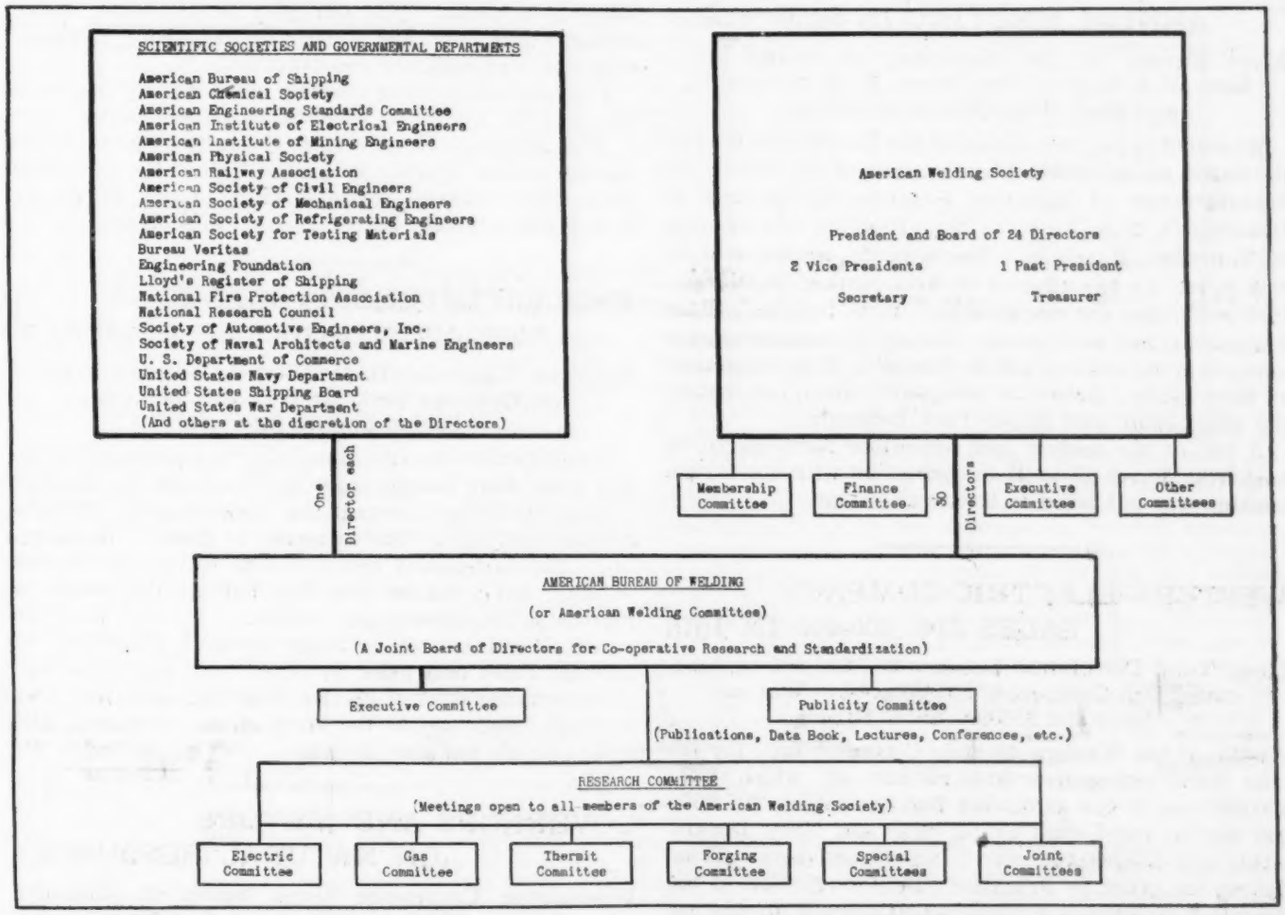
The society will give greater stability to welding by standardizing welding processes and thus make its economies available in a wider field of industry. The first meeting will be held on Friday, March 28, at the Engineering Societies Building, New York, at 10:30 a.m.

Shortly after the United States entered the war the Council of National Defense appointed an engineering committee which undertook as one of its chief tasks a study of the possibilities of electric welding in shipbuilding. This committee was taken over by the Emergency Fleet Corporation and, as the welding committee, later broadened its scope to include gas and thermit welding. When the armistice was signed its investigations were still in progress.

The welding committee, by its discussions, researches, lectures and conferences, its interchange with foreign countries and its dissemination of information, gave a great impetus to use of electric welding in this country. Concurrently with this work, another move to advance welding, with the emphasis on gas welding, was started by the formation of the National Welding Council, which accomplished important results.

The American Welding Society will bring together, in the manner usual for scientific societies, persons from all branches of the industry who may be interested in any of the welding processes—forge welding, electric resistance welding including spot welding, electric arc welding, gas welding, thermit welding, etc. In addition to this, it will have another function which alone would justify its existence. It will create and assist in maintaining a Bureau of Welding, which will be a separate organization designed to take full advantage of the principle of coöperation in research and standardization.

As part of its routine, the society will ascertain what specific investigation or assistance is needed in any branch of the industry. If this assistance involves research, a definite program will be arranged and presented to the portion of the industry affected, indicating the benefits to be derived therefrom. It is the intention to finance separately each research that is undertaken.



TO DISCUSS THE STATUS OF INDUSTRIAL LIGHTING CODES

G. H. Stickney to Present Paper at Meeting Arranged by the Lighting and Illumination Committee of the A. I. E. E.

The lighting and illumination committee of the American Institute of Electrical Engineers will hold a meeting at the Engineering Societies Building, New York, at 8:15 o'clock on the evening of April 11. The meeting is to be devoted to a discussion of the "Present Status of Industrial Lighting Codes in the United States." G. H. Stickney, past-president of the Illuminating Engineering Society and a member of the committee on lighting legislation of that society, will present the paper of the evening. The program for the meeting is purposely limited to one paper so that there may be time for an expression of many different viewpoints.

ASSOCIATED MANUFACTURERS' ANNUAL MEETING IN NEW YORK

More Details of the Gathering on March 20—Gov. W. E. Edge of New Jersey, R. K. Sheppard and Major Paul Debevoise to Speak

As stated in previous issues of the ELECTRICAL WORLD, the fourth annual meeting and banquet of the Associated Manufacturers of Electrical Supplies will be held at Delmonico's, New York, on the afternoon and evening of Thursday, March 20. The business session will be at 2 p. m. In the absence of President A. W. Berresford in Europe, the vice-president, B. E. Salisbury, Pass & Seymour, Inc., will preside. Among the speakers at the banquet in the evening will be Walter E. Edge, Governor of New Jersey; Robert K. Sheppard, first president of the association, and Major Paul Debevoise.

A list of the section and committee meetings to be held from March 17 to 21 in connection with the annual meeting was published in last week's issue.

WESTERN ELECTRIC COMPANY SALES $145,200,000 IN 1918

Large Total Distributed Between $67,800,000 to Associated Bell Companies, $21,800,000 to War and Navy and $55,600,000 to Others

Sales of the Western Electric Company, Inc., for the year 1918 aggregated $145,200,000, of which $67,800,000 was to the associated Bell companies, $21,800,000 was to the United States War and Navy Departments and $55,600,000 was to other customers. These figures are given by President Theodore N. Vail of the American Telephone & Telegraph Company in his annual report.

Mr. Vail adds that, although with the exception of 1917 this was the largest year's business ever done by the company, the very high costs of labor and material during the year, the unusual taxes, the writing down of inventory at the end of the year because of decreasing values of materials then on hand and other necessary reserves will probably result in only a small balance after the payment of the regular dividends.

The unfilled orders at the end of the year aggregated about $26,200,000 after deducting those canceled or likely to be canceled by the government on account of the cessation of hostilities. This is a decrease of $2,500,000, as compared with unfilled orders at Dec. 31, 1917, and it now seems probable that the total sales in 1919 will be considerably less than in 1918.

ENGINEERS TO AID NEW YORK RECONSTRUCTION COMMISSION

Engineering Council Names Five Prominent Engineers from Different Branches to Advise and Confer with New State Body

The following five prominent engineers, representing the several branches of the profession, have been selected by the Engineering Council to advise and confer with the Reconstruction Commission of the State of New York: George W. Fuller, Dr. George F. Kuntz, H. de B. Parsons, Lewis B. Stillwell and Paul C. Brown.

This body will be known as the Advisory Engineering Committee and is at present interested in the following public works: The vehicular tunnel, water-power developments, port and harbor developments, garbage, sewerage and highway construction.

This commission was recently appointed by Governor Smith, with Abram I. Elkus as chairman. The office of the Advisory Engineering Committee is with the Reconstruction Commission at the Hall of Records, New York City. Address correspondence in care of Walter S. Dickson, engineer Secretary for Public Works.

ENGLISH INTERESTS SOLD BY THE WESTINGHOUSE COMPANY

Securities Taken by United States Company in Electric Holdings, Ltd., in 1917 Are Reported Sold to English Interests

English interests, according to an announcement made this week, have bought from the Westinghouse Electric & Manufacturing Company for approximately $7,000,000 the holdings of that company in Electric Holdings, Ltd. The last-named company was formed in London in May, 1917, taking over the British Westinghouse Electric & Manufacturing Company. At that time the parent Westinghouse company received $6,500,000 of ten-year 5 per cent prior lien bonds and about one-half of the common stock of Electric Holdings, Ltd. Gen. Guy E. Tripp, chairman of the Westinghouse company, and other officials are now abroad.

GOVERNORS AND MAYORS ON NATURAL RESOURCES

Washington Conference Urges States to Consider Means of Releasing Resources from Those Who Willfully Withhold Use

During the conference of national officials with state governors and mayors of cities in Washington last week a resolution was adopted recommending "to the states that they consider means of releasing natural resources from controllers who willfully withhold such natural resources out of use for speculative profits or for visionary future development, thus contributing to non-employment." This was adopted in place of a resolution urging speedy enactment of the water-power, oil, coal and phosphate legislation.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Jovian Electric League, Los Angeles.—Senator George W. Cartwright spoke on the labor situation at the Feb. 19 meeting of the league.

Louisiana Engineering Society.—At the March 10 meeting held by this society W. T. Hogg's paper on "Suggested Changes in the Operation of the Street Railway System of New Orleans" was discussed.

Southwestern Electrical and Gas Association.—The fifteenth annual convention of this association will be held at Galveston, Tex., May 12 to 14. Details of the program will be published in a later issue.

Connecticut State Electrical Contractors' Association.—At the annual meeting of this association held in New Haven, Conn., on Feb. 20, E. S. Francis of Hartford was chosen chairman and George M. Chapman of Waterbury was made secretary.

A. S. M. E., San Francisco Section.—F. A. Anderson, electrical inspector of the United States Shipping Board, spoke before the Feb. 13 meeting of this section of the American Society of Mechanical Engineers on "The Present Status of Electrical Arc Welding."

Electric Club of Chicago.—"The New Competition" was the subject of R. E. Paterson Cline at the March 6 meeting of the club. The board of managers has been authorized to obtain full details on the matter of permanent quarters for the Electric Club, and submit a plan to the membership.

Illuminating Engineering Society, New York Section.—Two papers are to be presented before the March 20 meeting, which is to be held in the Engineering Societies Building, New York City. The first will be "Some Experiments on the Eye with the Different Illuminants" (Part 2), by C. E. Ferre and G. Rand, and the second "Transmission of Colored Light Through Fog," by C. L. Utterback.

A. S. M. E., Worcester Section.—Eskil Berg, General Electric Company, Schenectady, N. Y., gave an illustrated talk on "The Recent Development of Propelling Machinery for War and Merchant Ships" at the section's meeting held on Feb. 19. In his talk Mr. Berg described the electrically propelled battleship New Mexico. Dr. A. E. Kennelly gave a lecture on "Some Features of Electrical Engineering in the War" before this section on March 6.

High Tension Club.—At a meeting of the High Tension Club of Keokuk, Iowa, which took place on Feb. 18, C. W. Kellogg, manager of the Stone & Webster properties in the Middle West, read an interesting paper called "The Critical Period of the War," it being an analysis of the economic problems of the present, dealing with the relations of capital, labor and Bolshevism. J. L. S. Scadding and J. T. Wycoff, Mississippi River Power Company, are respectively president and secretary of the club.

Society of Industrial Engineers.—A national conference of the Society of Industrial Engineers on "Industrial Reconstruction Problems" will be held at Hotel McAlpin, New York City, from March 18 to 21. At a session on "The Influence of Engineering Education," of which Dean Herman Schneider, University of Cincinnati, will be chairman, papers will be presented by L. P. Alford, on "The Engineer's Place in Reconstruction"; by Norman A. Hill, on "The Need for the Engineer's Viewpoint in Industry"; by H. E. Miles, on "Training and Education of Workers," and by C. R. Dooley, on "Standards of Engineering Education." Leon I. Thomas will present a paper on "The Need for Labor-Saving Equipment" at the session on "Labor-Saving Equipment as a Factor in Maximum Production and Fatigue Elimination," which will have A. Russell Bond for its chairman. Other papers of importance on labor and kindred subjects will be read.

American Institute of Electrical Engineers

Denver Section.—G. N. Robinson of the General Electric Company spoke on "Electric Welding" on Feb. 15.

Philadelphia Section.—Dr. Joseph W. Richards spoke on "The Importance of the Electrochemical Industry" at the Feb. 10 meeting.

Schenectady Section.—Prof. F. W. Sexton will have for his subject "The Education of Crippled Soldiers" at the March 21 meeting of this section.

Fort Wayne Section.—C. I. Hall, Fort Wayne Works of the General Electric Company, is to speak on "Some Electric Developments Brought About by the War" on March 20.

Urbana Section.—"The Measurement of Small Alternating Currents by Means of an Acoustical Resonator" was the title of Dr. F. R. Watson's talk before the Feb. 26 meeting.

Minnesota Section.—"Electric Furnaces" was the subject discussed by L. H. Berry, metallurgist of the Western Crucible Steel Company, Minneapolis, at the Jan. 30 meeting held by this section.

New Year Book.—The 1919 year book of the American Institute of Electrical Engineers, containing the constitution of the society, lists of its members and other related information, is now being distributed.

Seattle Section.—At the Feb. 18 meeting papers were read by C. L. Coward and J. D. Ross on X-ray developments, by Dr. C. E. Magnusson on scientific research, and by G. R. Quinan on the work of the Bureau of Standards.

Annual Convention.—The thirty-fifth annual convention of the American Institute of Electrical Engineers will take place at the Lake Placid Club, Adirondacks, New York, in the week of June 23. Dates and details of the program for the convention are to be announced later.

Detroit-Ann Arbor Section.—Dr. Saul Dushman of the Research Laboratory, General Electric Company, is to speak on "Modern Applications of the Electron Theory" at the March 14 meeting. On Feb. 28 Prof. John C. Parker gave one of his round-table talks on "Alternating-Current Generators."

Indianapolis - Lafayette Section.—"French Warfare Ammunition" was the subject of Lieut. B. P. Lyons, Ordnance Inspection Department, and "Development in Signal Corps Apparatus During the War" that of Emerson Pugh, Electrical Engineering School, Purdue University, at the Feb. 11 meeting.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Daylight Service.—A decision of the Missouri Public Service Commission affecting the Iron County Electric Light & Power Company, Ironton, says regarding daylight service: "The only question at issue is whether the company shall be required to give daylight service. That there will be an additional expenses in the full operation of this plant as against its operation for a portion of the time only cannot be questioned. Whether there will be any loss in such operation cannot be estimated without an actual check of the sales during the day and night periods. From the record made in this case the commission is of the opinion that some daylight service should be given and is of the further opinion that the revenues to be secured therefrom will offset any additional expense therein incurred. It is the duty of the company to give its patrons a reasonable service. By written contract and by verbal promises the company has induced its patrons to invest in electrical facilities for the use of daylight current. It owes a duty to these patrons of furnishing this service, and it would appear that if the plant were placed in continuous operation from 12 o'clock noon until a reasonable time after daylight in the morning sufficient service would be rendered to the public. The period of inoperation in the morning hours would permit the company to have its boiler cleaned and do the necessary work upon machinery to have it available for operation during the other hours of the day."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Council Will Investigate Charges at Toledo.—A resolution has been introduced in the City Council at Toledo, Ohio, providing for an investigation of complaints against the Toledo Railways & Light Company of making excessive charges for service connections. It is also complained that power rates have been greatly increased. The resolution was referred to the railways committee.

Power-Plant Equipment Manufacturers Organize.—The International Power Economy Conference, formed in Chicago on Dec. 6, 1918, is beginning to perfect its working organization. A tentative list of committees has been drawn up and tentative appointments to these committees have been made. The general character of the work which will be done by the International Power Economy Conference is perhaps best shown by the names of the committees it will organize. These are committees to coöperate with the Fuel Administration and with the stoker association, and committees on foreign trade, combustion, solid fuel, washed and pulverized fuel, oil fuel, steam engines, steam turbines, oil engines, refractories, boiler feed water purification, steam superheating, cooling and condensing equipment, separator and trap economy, insulation and boiler covering, packing, valves, piping and pipe accessories, coal storage and handling, ash handling, steam and water meters, recording instruments, mechanical draft, and lubricants. Joseph Harrington is acting chairman of the conference.

Receivership of Fort Wayne & Northern Indiana Property.—Robert M. Feustel, receiver for the Fort Wayne & Northern Indiana Traction Company, has made the following statement: "For several years past the security holders of the Fort Wayne & Northern Indiana Traction Company have recognized that the earnings on the property were not sufficient to take care of operating expenses, taxes and the necessary fixed charges. For the last two years default has been made in the interest on more than 90 per cent of the bonded indebtedness of the company, and this interest money has been devoted to operation and betterments. During this period the security holders have been working on plans for a reorganization of the company, and the appointment of a receiver at this time is for the purpose of consummating some satisfactory reorganization plan. The company will continue in its efforts to improve service in both the railway and light and power departments, to the end that the public may obtain the best possible service under all conditions. The appointment of a receiver will not change the policy which has always been in effect on this property, of making sure that every one who has furnished materials for operation or maintenance is fully protected."

Electric Vehicle Charging Stations.—A chain of charging stations, extending in all directions from New York City, now makes it possible for electric vehicle owners to reach points a hundred or more miles away without fear of becoming stranded. A battery boost at Lakewood makes Atlantic City a fine one-day run; boosting stations in eastern Connecticut and central Massachusetts bring Boston within reach of the electric car; stations at New Brunswick and Trenton make the Philadelphia run easy, and south of Philadelphia there are charging stations all the way to Washington. Electric vehicle routes from New York to Philadelphia, to Atlantic City, to Easton, Pa., to Ellenville in the foothills of the Catskill Mountains, to Pittsfield, Mass., and to New Haven, Conn., are described in the 1919 automobile handbook just issued by the New York Electric Vehicle Association. Included is a complete list of charging stations in and near New York, with particulars as to capacity and rates. The booklet is designed to aid not only the electric vehicle tourist but the operator of electric commercial vehicles whose deliveries are in the suburbs. The book will be sent free to any one upon request to the association, Irving Place and Fifteenth Street.

Federal Trade Commission to Curb Misrepresentation in Sale of Stocks.—The Federal Trade Commission officially announces that it will take immediate steps to coöperate with the Treasury Department, the Capital Issues Committee and banking and commercial institutions throughout the country to curb the present widespread misrepresentation in the sale of stocks and securities, recognized as being at this time a particular menace to holders of Liberty bonds and war savings stamps. The commission will accord immediate consideration to complaints presented to it involving alleged fraudulent practices in the sale of securities in interstate commerce. The commission has designated Commissioner Huston Thompson to supervise the entire subject. The commission's action follows appeals made to it by representatives of the Treasury, Capital Issues Committee, Federal Reserve Board, Associated Advertising Clubs of the World and numbers of banking and commercial interests that the power given the commission under its organic act to prevent unfair methods of commerce in interstate commerce be at once employed to protect holders of government war securities from bogus "get-rich-quick" schemes under which promoters offer to accept Liberty bonds in exchange for stocks of doubtful value.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Confiscatory Rates.—Although Chapter 227 of the Laws of 1907, fixing maximum charge for illuminating gas in Albany, was not confiscatory when enacted, where, because of changing conditions, the rate fixed precluded a fair return to plaintiff gas company, there is "confiscation," and plaintiff has a remedy in the courts, its only right not being by petition to the Legislature, the Court of Appeals of New York hold (121 N.E. 772).

Separation of Tax-Exempt from Unexempt Property.—An electric light and power plant located on property exempt from taxation as being used for educational purposes may be taxed where, in addition to supplying the school, it is used to supply a neighboring town and its citizens with light if it and its value can be separated from the remainder of school property exclusively used for school purposes, the Supreme Court of Appeals of Virginia held (975 S. E. 805).

Property Status of Fixtures.—Electric lighting fixtures furnished and used for the purpose of equipping an office building and the labor performed in installing them are included in the term "permanent improvement of real property," as used in lien law, as it read in 1910, the Court of Appeals of New York holds (121 N.E. 763). Gas and electric fixtures, as ordinarily attached to a house or other building for use, are in actions between grantor and grantee, landlord and tenant, mortgagor and mortgagee, held to be personal property.

State and Municipal Rate Regulator.—The regulation of rates for services or a commodity furnished by a public utility is an exercise of police power, the Supreme Court of Ohio holds (121 N.E. 701). Section 3 of Article 18 of the Constitution of Ohio, as amended, confers upon the municipalities of this state authority to adopt and enforce within their limits such local police regulations as are not in conflict with general laws. An ordinance fixing the rate that may be charged for telephone services by a telephone company within the limits of a municipality is a local police regulation within the meaning of the term. The state statutes creating the Public Utilities Commission of Ohio and conferring authority upon it to regulate public utilities and to fix the rate that such utilities may charge for commodity furnished or service rendered to municipalities and citizens of this state are a valid and constitutional exercise of the police power by the General Assembly of Ohio.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

B. R. Laraway has resigned as manager of the Jackson (Mich.) district of the Consumers' Power Company to become vice-president of the Jackson City Bank.

Col. Peter Junkersfeld, who since the middle of 1917 has been an officer in the United States Army, returned on March 6 to his civilian work as assistant to the vice-president of the Commonwealth Edison Company, Chicago. Colonel Junkersfeld, who was twice promoted—major to lieutenant-colonel and then to colonel—had charge of the electrical construction of the cantonments. He joined the operating staff of the old Chicago Edison Company shortly after graduation in 1895 from the University of Illinois. His advance through the engineering department was rapid, and in 1906 he became electrical engineer for the company. Three years later he became assistant to the vice-president, in which capacity he has large responsibilities in connection with the company's engineering work. Besides being a fellow in the A. I. E. E. he has been very active in the work of the N. E. L. A., the A. S. M. E. and the Western Society of Engineers. During the war Colonel Junkersfeld was a frequent speaker before engineering bodies on the topic of cantonment construction.

PETER JUNKERSFELD

C. M. Brewer, manager of the Richmond division of the Western States Gas & Electric Company, has been appointed vice-president and general manager of the Mountain States Power Company, operating in Montana, Idaho, Washington and Oregon. Mr. Brewer became manager at Richmond for the Western States Company in the early part of 1913.

Secor Cunningham, Jr., has been appointed engineer of the newly created position of engineer of the transportation department of the Commonwealth Edison Company, Chicago. Mr. Cunningham, who was a captain in the Signal Corps of the United States Army during the war, was previously employed by the Commonwealth Edison Company as assistant to George B. Foster.

E. A. Burrill has resigned as general manager of the Northwestern Ohio Railway & Power Company, Toledo, Ohio. Mr. Burrill was formerly vice-president and general manager of the Peoria (Ill.) Railway Terminal Company.

Henry A. Reed, president of the Bishop Gutta Percha Company, an old-time telegrapher and one of the early workers on insulated wire, celebrated his ninetieth birthday on Feb. 11. Mr. Reed has always taken an interest in electrical affairs and continues to keep well posted on the developments within the industry.

Lieut.-Col. Charles Hamilton Mitchell, well known for his work in Canadian hydroelectric developments, has been appointed dean of the faculty of applied science and engineering of the University of Toronto, the largest engineering educational institution in Canada. Colonel Mitchell was born in 1872 and at the age of twenty was graduated from the University of Toronto. A few years later he began to engage in water power development in Ontario. From 1901 to 1905 he was principal assistant engineer for the Ontario Power Company. During 1906 he traveled in Europe studying hydroelectric developments, and since that time has been in partnership in Toronto with his brother, P. H. Mitchell, in consulting engineering, largely along the lines of hydroelectric development. Mr. Mitchell was consulting engineer to the Ontario Power Company when it doubled its capacity to 100,000 hp., and later to the water-power branch of the Canadian Department of the Interior. He has written a number of books on hydroelectric development. During the war he served as a general staff officer and was mentioned in dispatches on six occasions, winning the Distinguished Service Order, Companion of the Order of St. Michael and St. George, Officer of the French Legion of Honor, Officer of the Order of Leopold, Croix de Guerre (Belgium), Companion of the Bath, Officer of the Crown of Italy and Italian War Cross.

Charles S. Banghart, formerly vice-president and general manager of the Binghamton (N. Y.) Railway Company, has been appointed general manager of the Augusta-Aiken Railway & Electric Corporation of Augusta, Ga., by the J. G. White Management Corporation, New York, the operating manager, succeeding W. C. Callaghan, resigned. After leaving Lehigh University Mr. Banghart was employed successively on the electrifications of the Allentown & Bethlehem Rapid Transit Company of Allentown, Pa., and the Union Railway Company of New York City. In 1894 he became superintendent of the Flushing (N. Y.) & College Point Lighting, Power & Railway Company, and from 1895 to 1903 he was associated with the Interstate Railway Company of Reading, Pa. He was employed by the New York & Queens County Railway Company, Long Island City, N. Y., from 1903 to 1914, serving six years as general superintendent. In 1914 Mr. Banghart took up his duties as vice-president and general manager of the Binghamton company.

Lewis B. Stillwell, consulting electrical engineer of New York City, has been elected president of the American Institute of Consulting Engineers. Mr. Stillwell was born at Scranton, Pa., in 1863. He attended Wesleyan University for two years and then Lehigh University, from which he was graduated in electrical engineering in 1885. In the fall of 1886 he entered the employ of the Westinghouse Electric & Manufacturing Company and was soon promoted to assistant electrician. He retained that position until 1892, working with O. B. Shallenberger in the laboratory for a considerable time, where he was also associated with Nicola Tesla and the late William Stanley. In 1889 he visited Europe in the interests of the Westinghouse company and again in 1890. Later he became electrical engineer for the Westinghouse company. He has been in consulting electrical engineering practice in New York City for a number of years. Mr. Stillwell was president of the American Institute of Electrical Engineers in 1909-10.

L. B. STILLWELL

Obituary

Earl Coit Eldredge, an expert designer of electrical measuring instruments, died at Springfield, Mass., Feb. 27. Mr. Eldredge was born at Canterbury, Conn., in 1868, and after finishing his education he acquired the jewelry trade. His skill in designing delicate mechanism was ultimately turned into the electrical field.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

BETTER FEELING IN THE MARKET FOR TRANSFORMERS

Reduction Expected Shortly in Price of Small Units, After Which Prices Are Expected to Remain Firm for the Remainder of Year

Although the demand for transformers is far below normal, a better tone is apparent in the market. Two or three weeks ago buying reached perhaps the lowest point since the armistice began. Price reductions of the order of 10 per cent on larger transformers were quoted about that time, and a logical reaction can be seen in the increased number of inquiries now coming in. Business is still dull in comparison with the outputs and sales of a few months ago, but the outlook cannot be called discouraging, to say the least.

As soon as central-station development becomes freer the transformer market will respond quickly to the stimulus. The high cost of financing extensions of plant in respect to both money rates and the abnormal cost of apparatus has held back the growth of systems normally to be counted upon. Some signs of improvement are now noted by the transformer manufacturers. Raw material and labor are plentiful; factory stocks are in excellent shape for exceedingly prompt delivery of sizes ordinarily specified for distribution work, and in the larger units, say from 200 kva. upward, deliveries can be made in about one-fourth the time required last summer on orders carrying anything less than very high priority ratings. Virtually any commercial requirement in large units can now be met in from sixty to ninety days.

The price situation is of much interest at this time. There will probably be a reduction of about 10 per cent in the price of the smaller sizes of transformers soon, possibly within a month or two. The opinion is advanced in reliable circles that following this reduction no further decline in prices is to be expected before the year is nearly over. The point is emphasized that electrical equipment of the transformer class was advanced only about 60 per cent in price during the war, compared with advances of from 100 to 300 per cent in many other manufactured products.

The price paid to labor appears likely to continue to be high; much material purchased at high prices is at hand to be worked up before lower cost material will be available, and with the exception of copper very little reduction has taken place in the cost of supplies entering into transformer construction. The high-grade steel and insulation needed show little or no tendency to weaken in cost. Consequently, in view of the strong probability that labor will be able to command very high wages compared with pre-war standards, and because of the continued high cost of most material and of the conservation of the electrical manufacturers in raising prices under the stress of war, the transformer buyer of 1919 will take no great chances if he places his orders almost immediately.

It is well to remember that transformer prices per kilowatt of capacity have long compared very favorably indeed with other equipment built to deliver energy efficiently in bulk. It is to be doubted whether transformer prices will go back to a point 30 or 40 per cent above pre-war levels in any future which can be apprehended now. Had it not been for the excellent progress toward standardization begun before the war and continuing to this day, prices would have been carried considerably higher than was actually the case. So far there have been few transformers released from war plants for the second-hand market, and the effect on prices has been negligible. There does not appear to be much ground for disquiet in this field, judging from experience in connection with second-hand motors of high quality which have been put upon the market after a tour of duty in war-plant operation.

RELATIVE POPULARITY OF INCANDESCENT LAMPS

Fifty-Watt Vacuum Lamp Gaining Fastest—The 100-Watt Size Has Proved to Be the Most Popular of the Gas-Filled Type

A prominent Eastern lamp manufacturer reports that sales of all tungsten lamps increased 22 per cent over the previous year's record in a recent analysis, there being a 52 per cent gain in the gas-filled type and an 18 per cent gain in the vacuum type. The 40-watt lamp still continues to be the most popular size, representing now 25 per cent of this maker's output, with the 25-watt size second and the 60-watt lamp third, the latter being one-seventh of the total. The 50-watt lamp is gaining fastest of all the vacuum lamps, and promises to become the standard central-station type, though it has been on the market less than three years. The 100-watt unit continues to be the most popular gas-filled unit, its sales being nearly 50 per cent in excess of the 100-watt vacuum type for the year. Sales of the 75-watt gas-filled lamp doubled in the year.

STREET-LIGHTING EQUIPMENT HAS BECOME MORE ACTIVE

Difficulty of Financing New Construction Has So Far Prevented Public Utilities from Going Ahead in This Direction

Just now the market for steet-lighting equipment seems to be coming to life again. A few new projects have definitely been decided on, and inquiries on others are coming in. An Eastern district office of one prominent producer reports that it is working on inquiries aggregating in the neighborhood of 3000 standards.

During the past two years there has been little demand except for such types as could be adapted to use in industrial yards, in cantonments and around other government property. The ornamental types of equipment had very little new development. The metals entering into the manufacture of the standards were difficult to secure, and the ban on new developments in glassware curtailed work in that direction.

There was much work done, however, along engineering lines in the laying out of systems for many communities, in the hope that the close of the war would bring into being extensions of lighting into new streets and changes from obsolete to up-to-date systems. But the trend of operating costs has placed such hardships on lighting companies that they have had difficulty in seeing their way clear to the financing of the extensions.

A plan that has been brought forward by a representative of a large manufacturer to assist lighting companies in their financing is that the city shall purchase the necessary equipment, allowing the lighting company to pay for

it over a period of five years, either through straight payments periodically or through a change in rate. This would leave the equipment in the hands of the company at the end of the normal city contract period.

One big factor in the development and extension of street lighting has been vehicular traffic between neighboring cities. Originally street lighting was a police measure, but in recent years intercity traffic on the highways has brought the necessary lighting, and street lighting has brought and increased to a large extent this same traffic in its turn.

Furthermore, recent developments in transformers permits of the automatic control of series street-lighting circuits at any distance from the power house, thereby eliminating the expense attendant on constant current control for new extensions which may be needed far from the power house.

The field of application for the use of electrical energy which may be opened up through the medium of street lighting in outlying districts is, of course, very large.

METAL MARKET SITUATION

Copper Starts Upward for First Time in Four Months—Tone Better

Conservatism and caution still dominate the general trade situation but the larger volume of buying in both primary and secondary markets has been noted in the Northwestern and large Southern cities.

Copper for the first time in four months took a slight turn upward of one-quarter of a cent. It retreated, however, and stands at 14.87½ cents. It has been reported that some of the smaller companies have offered the metal at 14 cents a pound, and that even at such a low price they have been unable to uncover any sizable orders. However, the outlook is more encouraging than at any time since the signing of the armistice, and a better domestic demand is developing. The price of copper in the London market advanced £3 to £77.

The lack of any important foreign demand and a dark outlet for exports in the near future still have a depressing effect. Electrolytic is reported difficult to buy even at 15 cents for spot or April delivery.

Although the copper companies have ratified the agreement entered into with the government representatives concerning the disposal of the government's supply of copper, the federal authorities have not as yet ratified it.

Spelter and aluminum have dropped very slightly. Prices in the old metal market have become very stable. This can hardly be attributed to active demand.

NEW YORK METAL MARKET PRICES

	March 4	March 11
Copper:	£ s d	£ s d
London, standard spot	74 0 0	77 0 0
	Cents per Pound	Cents pr Pound
Prime Lake	16.00	15.50
Electrolytic	14.87½	14.87½
Casting	14.75	14.75
Wire base	18.75 to 19.00	18.75 to 19.00
Lead, trust price	5.25	5.25
Antimony	7.00 to 7.12½	7.00 to 7.12½
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	11.00	11.00
Spelter, spot	6.62½	6.50
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent.	31.50	30.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	12.75 to 13.75	12.75 to 13.25
Brass, heavy	7.25 to 7.50	7.25 to 7.50
Brass, light	6.00 to 6.25	6.00 to 6.25
Lead, heavy	4.75 to 4.87½	4.75 to 4.87½
Zinc, old scrap	4.50 to 4.75	4.50 to 4.75

THE WEEK
IN TRADE

MARKET conditions in general have continued quiet. On account of labor conditions in the Northwest building in that territory has not opened up, but in other sections of the country there has been a noticeable increase. Figures show large increases in letting contracts for building and engineering operations in February over January in the Middle Western States, but smaller increases in New York and northern New Jersey. In this latter section February increased nearly $5,000,000 over January, while in the Middle West it increased $82,000,000. Declines were reported in New England and Washington, Baltimore and Philadelphia, but in these cases new building developments were unusually large in January.

Prices of many materials are gradually decreasing, but sufficient confidence apparently has not been developed to cause much movement in the electrical market. Considerable activity in the appliance market as a whole shows the desire of the individual to buy rather than the investing interests.

NEW YORK

Labor conditions have not improved. There is still considerable tendency toward demands for higher wages, and in several trades labor has voluntarily left its work. The discharge of workers from factories in this state from November last to February has been reported by the State Industrial Commission as constituting a decrease of employees amounting to 7 per cent.

Some jobbers are reporting surplus stocks with very little movement. The shipbuilding industry has considerably decreased. Schedule material is in general very quiet, but one jobber reports that within three days 15,000 pull-chain sockets were sold within seven blocks of his store, and he predicts the sale of 50,000 more within a very short time.

The outlying districts are rather active, and pumps and farm-lighting sets have been reported as enjoying considerable sale. From the sale of these and household appliances it appears that domestic uses are providing considerable market, while the investing interests are practically inactive.

Collections have been reported by jobbers as satisfactory, and credits are good. Trade acceptances are assisting the credit conditions very well. There is a tendency to eliminate cash discounts.

MEDICAL APPARATUS.—A very good market has been reported for hair dryers, vibrators, heating pads and lamps for projecting rays for local heat applications.

VACUUM CLEANERS.—The market continues satisfactory. Deliveries are behind on one make, while on other makes local stocks seem to be ample.

WASHING MACHINES.—Generally speaking, local stocks are good, although in one line a shortage is reported. The demand is very good, and in one instance a dealer is selling from catalog against expected shipments.

ELECTRIC STOVES.—Apartment house restrictions against gas in kitchenettes in converted houses have made a favorable market in New York City for disk stoves where high rates would otherwise prevent their use. These have run into rather high numbers per house.

MOTORS.—Large orders have been reported from the garment trade for motors for both group and individual sewing-machine drive.

CONDUIT.—Reports have shown about a 5 per cent drop in price, there being a 2½ to 4 per cent change in brokerage in carload lots. Manufacturers are delivering on back orders placed on lower cards. In one instance a

local jobber is receiving conduit on an order placed two years ago at the price current when the order was placed.

STAMPED STEEL BOXES.—Discounts are reported at 60 per cent, a decrease in net price of about 18 per cent.

TRANSFORMERS.—Distribution type up to about 25 kva. have opened up very well in the last two weeks.

LIGHTNING ARRESTERS.—One of the largest manufacturing concerns reports that recent orders have absorbed its entire output for the next three months.

STORAGE BATTERIES.—Edison storage batteries, types A, B and G cells, have dropped approximately 16 per cent effective March 1 for April 1 and later delivery. However, there is a 15 per cent cancellation charge. This reduction virtually wipes away all increases made during the war.

MILL-TYPE LAMP.—Factory facilities of one manufacturer have increased considerably, permitting virtually stock deliveries.

FANS.—The Emerson Electric Manufacturing Company has announced that prices on portable fans have been advanced to include the federal excise tax of 5 per cent.

RUBBER-COVERED WIRE.—The average base has dropped approximately 2 cents to 20.8 cents. One manufacturer quotes on 23 cents, three on 22 cents, five on 20 cents, one on 19 cents and two on cost.

BOSTON

Although business continues rather quiet, the underlying tone is better. Stocks are still rather large, with the exception of appliances. Deliveries are generally good, though some difficulty is reported in getting vacuum cleaners enough to meet the demand. Prices are holding firm in most lines, and the reductions in copper-wire base quotations this week are of the order of ¼ cent per pound, with the exception of rubber-covered, which is quoted at about a cent below last week's figure. Collections are rather slow at present. In banking circles there is a disposition to relax the interest rate on building loans about one-half of 1 per cent, which it is hoped will stimulate activity. Labor conditions show less unrest this week. A reduction of 15 per cent took effect March 1 on alkaline batteries. Although the central stations are pursuing an extremely conservative policy regarding extensions, they are branching into vigorous advertising here and there for adding socket appliances to their lines.

VACUUM CLEANERS.—The demand is brisk, and prices hold firm. Some types are considerably behind on deliveries, so that it is necessary to order further ahead than usual in meeting the requirements of the market.

STORAGE BATTERIES.—Inquiries for road-truck batteries are coming in well, but the industrial truck battery demand is at present below normal. Stocks are in good shape. Following a cut in prices of 16 per cent March 1 in alkaline batteries, business has taken a decided spurt. The above reduction offsets the last advance.

FIRE-ALARM SIGNAL APPARATUS.—The municipal business hoped for has not materialized, despite the fact that the price increases in this class of equipment total only 25 per cent compared with pre-war figures. The factories are handling a fair amount of maintenance and replacement business, with occasional new box orders, but system orders are few and far between. There is a good demand at present among high-class industrial concerns for private fire-alarm equipment. By and large, the city and town business probably does not exceed 50 per cent of that enjoyed in 1917.

ELECTRIC HEATING APPARATUS, DOMESTIC.—Business is brisk and the principal difficulty seems to be to obtain raw material in sufficient amount to yield the production demanded by the current orders.

SUBWAY BOXES.—An improved demand is noted.

WIRE.—Lower prices are stimulating demand somewhat. This week bare copper is quoted at 17.75 cents base, weatherproof at 20.75 cents and rubber-covered at 21 cents.

ELECTRIC COAL-LOADING EQUIPMENT.—Stocks are favorably conditioned for immediate delivery in standard machines. Sales are rather sluggish for the moment.

MOTORS.—Prices continue steady. Eleven leading distributers said Monday that no general reductions have been made in quotations, that stocks are in good condition in smaller sizes of motors, and that deliveries are improving in larger units. The local demand is nothing to boast of at present, though it is said that in the country as a whole the first eight weeks of 1919 showed almost as much total motor business as the corresponding period of last year. One Boston distributer actually increased his motor sales a little in this period. Some anxiety is beginning to be felt about the release of motors from war plants rapidly approaching the end of their contracts. The prediction is made that new motors will not be sold much below present levels for at least six months

FIBER CONDUIT.—Inquiries incline dealers to believe that central-station construction will shortly show a revival of activity, at least on a moderate scale.

WASHING MACHINES.—The supply appears plentiful at present, with a well-maintained demand. The deferred payment system is an important distribution factor.

ATLANTA

There appears to be increasing activity in the demand for all lines of material this week. Manufacturers and jobbers report a number of inquiries for apparatus and schedule material from industrial centers. Trade on the whole is well sustained through purchases from central stations and industrials.

A building and construction boom has started at certain Florida cities, Miami and Jacksonville being the most active. Jacksonville municipal, business and shipping authorities are making preparations for increased trade relations with Latin-American countries. The next few months will see the installation of improved port machinery.

Reports for the current week show a greater increase in the number of unemployed, but at the same time a greater demand for common labor. In the Southeastern cities affected by strikes the scarcity of skilled workers is more acute, but as these conditions are spotty they do not reflect the general tendency. The two government-operated shipbuilding plants at Brunswick, Ga., reduced their forces about half this week. The hold-up in work is expected to be only temporary.

RANGES.—The demand has slowed up lately, and all interests are putting forth greater efforts to stimulate this line during the coming spring and summer months. Shipments have reached the point where prompt deliveries in large quantities can be made.

HEATING APPLIANCES.—Jobbers report an increasing call from the contractor-dealers. Shipments are coming in freely, and Southeastern stocks are in good shape.

CABLE.—Electrical contractors are apparently becoming more active as indicated by the movement of the heavier cables this week. A number of jobs that were delayed around the first part of the year are being completed. March 3 saw a reduction of weatherproof and rubber-covered copper base to 20 cents. Manufacturers report a slight decline in orders accompanying the weakening of copper products prices. Deliveries are good, covering all immediate requirements.

POLES.—Comparing the volume of business to-day with that of a month ago, the tendency shows a falling off. An interesting feature in connection with this line, however, is the fact that while government requirements have eased up, the demand from other sources shows a decided gain, which has helped to maintain a very satisfactory volume of business. No change in price has been recorded and shipments are much freer.

HARDWARE.—Following a drop in price, the call for standard material and miscellaneous items shows sluggish tendencies. Deliveries are good and stocks are in fair shape.

INSULATORS.—Activity is fairly well sustained in the glass type and shipments have shown a decided improvement. There has been no change in price of porcelain insulators since February, and although a substantial reduction took place at that time, business did not respond and

a period of dullness is noticed. Manufacturers are looking forward to an active spring demand, however, as factory facilities are much improved.

CHICAGO

Plans are being made for new buildings of practically every description. During the week "loop" building projects were increased by the announcements that both the Stratford and the Grand Pacific Hotel are to be demolished to make room for more modern structures. Extensive additions will be made to the Congress, Blackstone and Morrison Hotels as soon as prices of building materials become more attractive.

Most jobbers say that February this year was better than a year ago. Prospects for this month are not so good, however, judging by this first week. There are plenty of inquiries but few orders. It is believed that many of the inquiries are simply to supply information required on tax returns. Part of the decrease in business is ascribed to the failure of Congress to pass the railroad appropriation.

WIRE.—The base on both rubber-covered and weatherproof wire is around 20 cents this week, but there is not much being sold. Buyers are afraid to commit themselves.

CONDUIT.—There is no change in conduit prices, although steel prices have dropped. However, there is less hesitancy about buying conduit at the high price than there is in ordering wire at its reduced price.

FANS.—Fan business is beginning to open up with the dealers. The new 5 per cent luxury tax is being added to the price of every fan. Some make out invoices for the gross amount including the tax, but where jobbers have contracts the tax is usually added as a separate item.

AUTOMOBILE LAMPS.—Deliveries are getting much better and the demand is maintained.

TIME SWITCHES.—Manufacturers of time switches are not in a position to go after business aggressively at this time. The stocks of clocks are practically exhausted, although the output, which is still small, is steadily increasing, and it should not be long before the time switch manufacturers are again able to get all the clocks they want.

MOTORS.—At the present time deliveries of motors up to 50 hp. are good, but orders are falling off.

SEATTLE—PORTLAND

The Seattle, Tacoma and Aberdeen steel and wooden shipbuilding industry, which has been paralyzed by the strike since Jan. 21, resumed operations on March 11. Workers will return under the Macy board award in effect before the strike. The Metal Trades Association will also resume operations. It is estimated that a week or ten days will be required before full crews will be back on their jobs. With the expiration of the Macy award agreement on March 31 individual shipyards will be required to deal with their own employees. At that time the government will cease to make guarantees and enter into agreements, but will stop the construction of vessels contracted for if employers pay the disproportionate wages demanded by the men. Resumption of shipbuilding will do much to solve the labor problems directly. A solution of the non-employment problem in Oregon is rapidly taking form.

Lumber conditions throughout the next eighteen months are viewed with optimism by the Pacific Northwest lumbermen. It is believed that the latter part of this month will show a decided increase in the amount of residence construction all over the Northwest. Much building activity has been planned throughout eastern Oregon and eastern and southwestern Washington. Larger cities in the Puget Sound district are expecting a decided increase as soon as settled weather is assured. Larger building projects are being held up awaiting the settlement of labor difficulties and an expected decrease in building materials.

Electrical jobbers as a whole in Seattle during the past week report business very quiet. There were no sales reported of any importance, although the usual number of inquiries were received.

Business transacted by dealers showed a decrease. It is believed that with the reopening of yards and shops the normal volume will be regained speedily. The Portland district reports that retail business for the month of February has been good—almost equal to that of 1918. There was no marked movement of any special line. Wholesale stocks are reported in good shape owing to the fact that jobbers had placed orders previous to the signing of the armistice which manufacturers refused to permit them to cancel. Large purchasers are buying just enough to care for immediate needs. Jobbers report that sales are good in general, although not up to a year ago. Central stations are placing considerable orders for materials necessary for maintenance purposes. It is believed that proposed extensions or the major portion of contemplated projects will await a settled and a lower market. The Pacific Power & Light Company, Portland, officially announces that it is prepared to install a 5000-hp. generating plant at a cost of approximately $400,000. This company has purchased transformer equipment with a rating of 10,000 kw. to be used at Lind, Wash., in connecting the Pacific Power & Light Company lines to those of the Intermountain Power Company.

SAN FRANCISCO

Although one still hears talk of hand-to-mouth buying, still the aggregate business has been very good, and even those who complain about the waiting tendency of most buyers and builders admit that if this is the kind of business that is being placed in a season supposed to be quiet, then business when it does come will make a bumper year. Although there has not been much apartment-house building yet, still many private owners have decided to take advantage of a few small reductions in the cost of various building materials to begin construction, and the residence districts of many cities, particularly those of the better sort, show great activity. Recent buildings reported include new canneries at San José, Modeste and Sacramento, public buildings such as court houses and banks in Fresno and Blakersfield and big government construction in the sea-plane school near San Diego. Arizona especially is showing a marked increase in construction, and significant of the tendency to make the West more of an industrial center are the reports that a factory and warehouse for pipe and steel construction will be partly built in Phoenix.

Credits and collections are good. There is an increased tendency on the part of certain dealers to handle higher-priced devices, such as domestic helps, on a monthly basis scheme.

POLE-LINE HARDWARE.—Bolts and braces have again taken a small drop. Recent changes aggregate about 15 per cent.

POLES AND CROSS-ARMS.—There have been no recent changes in price schedules. Were there a demand, deliveries would be far easier than last year, since the government is not now so active in the north woods in procuring its aëroplane wood. The lines also will be affected by the proposed power-line construction.

RUBBER-COVERED WIRE.—All sizes of rubber-covered wire, with the exception of the circular-mil sizes, have again dropped 5 per cent. No. 14 single-braid solid is now selling for about $13 per 1000 ft. on the coast in 5000-ft. lots. Deliveries and stocks are good, and the demand, especially for house-wiring sizes, No. 14 in particular, is indeed good.

LAMP CORD.—Lamp cord has recently decreased 10 per cent, which is a considerable drop when it is figured that a comparatively small amount of the cost of the cord is copper cost. Dock cable is being offered in large lots at special prices owing to the stocks of marine cords ordered, especially for the emergency fleet, that are being carried over into this year. The local demands for all lamp cord have been rather light, although some fairly good export orders are reported.

SCHEDULE MATERIAL.—Sockets are in good demand, although in the smallest quantities possible to secure fair prices. Push switches are very slow.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20%
Coil to 1000 ft	List
	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00
	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	List to +20%
1/5 to std. pkg	20% to list
Std. pkg	17% to 36%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to List
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 36%

BATTERIES, DRY
NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued
CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.35 to $0.362	.35 to .372
Barrel lots	.326 to .332	.326 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
¾	100	10.00
⅞	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25 to $78.75	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
¾	.09	1½	.40
⅞	.12	1¾	.47
1	.15	2	.55
1¼	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$25.00–50.70	$24.00–35.20	$23.00–30.25
½-in.—	30.00–56.40	28.00–38.40	26.00–33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$60.00	$30.00	$26.00–26.50
½-in.—	65.00	32.00–32.50	29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
⅛	$0.08½
¼	.08½
⅜	.08½
½	.11½
¾	.17
1	.23
1¼	.27½
1½	.37½
2	.58½
2½	.76½
3	

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
⅛	$0.05	$0.19
¼	.06	.19
⅜	.07	.19
½	.10	.25
¾	.13	.37
1	.17	.45
1¼	.21	.50
1½	.28	1.10
2	.40	1.80
2½	.60	4.80
3		

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7.1%	9% to 9.1%
2500 to 5000 lb.	10% to 10.1%	12% to 12.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+3%	+1% to 2%
2500 to 5000 lb.	+1% to 2%	+4%

(For galvanized deduct six points from above discounts.)

FLATIRONS
NEW YORK

List price	$6.50 to $7.00
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.50
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$32.18—$40.77
Coil to 1000 ft.	28.60— 32.98

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$32.00—$36.00
Coil to 1000 ft.	25.00— 27.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$25.00 to $51.33

CHICAGO

Net per 100	$33.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1¼, 4 S.	30.00
103—C.A., 9, 4R, B 1¼	25.00
106—F.A., 7, C.S., 1¼, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%–32%	10%–27%
$10.00 to $50.00 list	30%–40%	20%–35%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	5%
1/5 to std. pkg.	15%
Std. pkg.	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $21.00
1/5 to std. pkg.	17.00 to 17.85
Standard package, 2200. List per 1000, $21 to $34	

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$21.00–$24.15
1/5 to std. pkg.	17.85– 21.00
Standard package, 2200. List per 1000,	$20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid	Std. Pkg. 4000 Nail-it—N.C.
Less than 1/5 std. pkg.	$16.00	$26.00
1/5 to std. pkg.	13.60	21.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid	Std. Pkg. 4000 Nail-it—N.C.
Less than 1/5 std. pkg.	$13.00–$18.40	$32.00–$36.80
1/5 to std. pkg.	11.50– 16.00	27.20– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 std. pkg.	List to 10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%+15%
$10 to $25 list	+10% to 2%
$25 to $50 list	+5% to 5%
	Low Grade
Less than $10 list	+15% to +5%
$10 to $25 list	2% to 8%
$25 to $50 list	5% to 15%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+30% to list
1/5 to std. pkg.	+5% to 10%
Std. pkg.	8% to 18%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 18%	Net
$2.00 to $10.00 list	10% to 28%	5%
$10.00 to $50.00 list	20% to 45%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $6.50
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.00
Discount	20% to 30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.41–$0.66
No. 18, full spools	.39– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.60 to $0.90
No. 18, full spools	.53 to .64

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.50–$25.00	$10.50–$17.00	$10.50–$15.00
12	20.20– 27.09	18.18– 23.22	15.15– 23.22
10	27.00– 32.40	24.30– 32.40	19.44– 27.45
8	33.12– 45.72	30.36– 45.72	26.50– 38.10
6	52.50– 72.36	48.13– 60.30	42.00– 57.88

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$19.50–$20.00	$14.50–$15.00	$13.00–$14.50
12	17.50– 24.57	17.55– 24.57	17.55– 21.06
10	24.05– 32.97	24.05– 32.97	21.16– 28.26
8	33.35– 46.69	33.35– 46.69	29.35– 40.02
6	52.95– 73.71	46.60– 63.18	46.60– 52.65

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$26.75 to $34.75
25 to 50 lb.	26.75 to 34.75
50 to 100 lb.	25.75 to 33.75

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$32.75 to $35.75
25 to 50 lb.	31.75 to 34.75
50 to 100 lb.	30.75 to 37.25

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Inclosed Lighting Unit

By using aluminum for finishing the interior of the reflectors of a recently developed unit, Shapiro & Aronson, 20 Warren Street, New York City, have obtained what they claim to be a very

ALUMINUM USED FOR FINISHING INTERIOR OF REFLECTORS

efficient and economical unit. This unit, which is known as Sa-Lite, is inclosed and is therefore dust-proof and bug-proof. It is said to have a wide range of commercial applications and presents a good-looking appearance that makes it extremely favorable for this type of service. The unit is shipped completely wired and adjustable for immediate installation.

Triple-Illumination Lighting Fixture

Elimination of eye strain and the utilization of direct, indirect and semi-indirect illumination are pointed out by the Dempsey-Glavin Electric Corporation, 408 West Thirty-fourth Street, New York City, as some of the features of the Dempsey light unit which it is manufacturing.

An upper section and a lower section compose the main parts of the unit, which is customarily suspended by four chains. The upper reflector, which is oblong and has sloping sides, is formed either or metal or glassware with metal edges and has a lining of opalescent glass. The lower reflector is also made of metal or glass and has a lining of white glassware. Placed in the top of the upper section is an inverted reflector whose outside forms a portion of the upper reflector and whose inside serves as a means of directing light toward the ceiling for reflection. Two bulbs are used, one in the ceiling reflector and a larger one attached to a socket in the bottom of the ceiling reflector but inclosed by the lower section. These two bulbs are controlled by separate pull switches. By using the top light in the ceiling reflector indirect illumination is obtained, and by using the lower light direct illumination is given through the bottom of the lower reflector and semi-indirect illumination by the rays reflected from the inside of the upper section. When both bulbs are in use the entire three types of illumination are obtained.

The lower reflector is adjustable so that when raised toward the upper section the reflective rays are broadened and when lowered away from the top section the rays are narrowed. The maker says that the fixture's ventilation is exceptionally good since free circulation for air is provided up through

GIVES DIRECT, SEMI-INDIRECT AND INDIRECT ILLUMINATIONS

the lower section and in the upper reflector, thus lengthening the life of lamp bulbs. This unit may be obtained with plain or decorated glass sides, with metal sides finished in bronze or brushed brass, or with a special lower reflector adapted for library use.

Electric Soldering Device

A novel electric soldering device for light soldering work, in which the metal to be soldered is heated directly by an electric arc established between two carbon points, has been developed by J. H. Hendricks, 513 Congress Building, Detroit, Mich. Closing the tool brings the solder into contact with the electrodes. The device is designed to be attached to a 6-volt storage battery, but can, of course, be used on ordinary lighting voltages in connection with a step-down transformer.

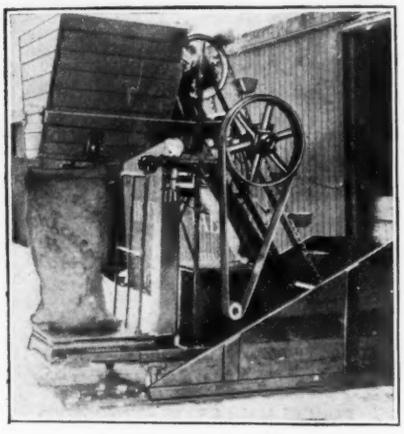
As pointed out by Mr. Hendrick, all of the heat is applied directly at the point where it is needed, and only during the time necessary for soldering, so that about one-tenth of the energy consumed by other soldering irons of equivalent capacity is required. The device is always ready and the work-

CORDS ATTACHED TO BATTERY BY CLIPS

man does not have to wait to heat up the tool before making use of it. It is of light and simple construction, and the way in which the solder is fed makes for the greatest economy in the use of soldering metal.

Electrically Operated Grain-Bagging Machine

While it is more economical to buy grain in bulk, the cost of hand bagging (2 cents per bushel under average con-



GRAIN DELIVERED DIRECTLY FROM CAR TO BAG

ditions), and also the fact that the work has to be done promptly in order to avoid demurrage freight charges, often preclude doing so. The equipment illustrated herewith, which was recently developed by the Conant Ma-

chine Company, Concord Junction, Mass., for service in unloading cars for retail dealers and others, as well as in bagging from bins, will bag grain in about half the time required by hand. This, according to the manufacturer, makes it possible to unload and bag a car of oats or corn, about 2000 bushels (705 barrels), in five to six hours, against the two and sometimes three days required by the old hand methods.

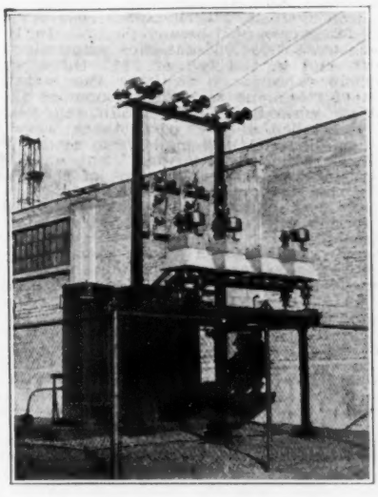
The equipment consists essentially of a bucket conveyor driven by a ¾-hp. electric motor mounted on a steel frame.

Compact Armature with Internal Commutator

Instead of using cotton-insulated armature conductors in its new motor-dynamo, the Dayton (Ohio) Electrical Manufacturing Company employs hair-pin-shaped flat-copper strips which are inserted in closed slots and insulated with bakelite after assembly. The ends of the conductors are welded to the commutator, which is of the internal type; i.e., contact is made on the inside rather than on the outside. Twelve brushes are used because of the heavy starting duty of this motor, two being of almost pure graphite. This outfit, whch was developed for automobile starting and lighting service, is furnished with a starting switch and automatic battery cut-out. While starting, the batteries are connected in series to give 12 volts, whereas when operating as a generator the machine develops 6 volts.

Unit-Type Steel-Frame Outdoor Substation

Instead of supplying large individual power consumers from 2300-volt distribution lines, it is often desirable for



COMPLETE 600-KW., 13,200-VOLT THREE-PHASE INDUSTRIAL SUBSTATION

central stations to supply them directly from high-tension transmission lines. The Delta-Star Electric Company, 2433 Fulton Street, Chicago, has developed a unit-type 13,200-volt, three-phase outdoor substation for supplying power directly from transmission lines. A steel-frame structure is used and is equipped with long-turn choke coils, disconnecting switches and limit fuses for use with oxide-film arresters. A three-pole, double-break-per-phase, fused-type air-break control switch is installed on a separate pole ahead of the substation and is used for entirely isolating the substation. This eliminates all chances of danger when working on the apparatus.

Locally Controlled Commercial Lighting Unit

To meet varying requirements in the proper illumination of offices, factories, stores, meeting halls, schools, armories, etc., S. Edw. Eaton & Company, 585 Hudson Street, New York City, have developed the "Econolite," which is made in several sizes accommodating gas-filled lamps ranging from 75 watts to 1000 watts. The intent and purpose of the design, say the makers, and the selection of material for this unit were to provide a means to diffuse properly the pow-

DIRECT RAYS ARE SPREAD OVER LARGE AREA WITHOUT GLARE

erful light of the gas-filled lamp without sacrificing a large percentage of its candlepower. The lines of the translucent reflector and the relation of the diffusing dish to it meet the requirements of a broad spread of reflected light, while the diffusing dish breaks up the direct rays of light and renders a soft white light without the glare.

A distinctive feature of the unit is in its method of affording local control. The pull chain from a standard socket is guided around the bulb and out through the bottom of the dish support, thus accentuating the balance and symmetry of the fixture and eliminating the installation of the pendent switch or wall switch.

Direct and Indirect Lighting Unit

Among the features which J. Livingston & Company, Grand Central Terminal, New York City, claim for the "Economy" light, which they recently developed, are simplicity in construction to allow for cleaning, economical initial cost of unit, small energy consumption, total absence of glare and long life of the lamp bulb due to maximum ventilation.

The fixture is simple and pleasing in outline and is well proportioned. A soft, direct downward illumination is given through the "Celestialite" glass

DISH IS OF DAYLIGHT GLASS AND REFLECTOR OF PORCELAIN ENAMEL

dish. Indirect downward illumination is obtained by means of the outside of the porcelain-enameled reflector and the ceiling. The unit may be used in homes, studios, offices, stores, factories, etc., and may be obtained in both plain and decorated styles.

NOTES ON RECENT APPLIANCES

Motor-Driven Screwdriver

The George C. McKay Company, 4247 Greenlee Avenue, Cincinnati, Ohio, has placed on the market an electrically driven nut, bolt and lag-screw driver.

Flexible Heater

A flexible electric heater which may be used for thawing frozen water pipes, for heating the intakes of automobile engines and for other uses is being sold by the Despatch Manufacturing Company of Minneapolis.

Alternating-Current Fan

A series transformer in the base of the motor has replaced the choke coil for speed controlling in the 12-in. and 16-in. (30-cm. and 41-cm.) desk and wall fans made by the Westinghouse Electric & Manufacturing Company.

Hand and Face Dryer

The "Airdry," a machine for drying the hands and face by electrically heated air, made by the Borton Electrical Devices, Inc., Groton, N. Y., and which was described in the May 4, 1918, issue of the ELECTRICAL WORLD, has been recently improved.

Trade Notes

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A man in Italy (No. 28,564) desires to secure the representation of firms for the sale of electrical apparatus.

A firm in France (No. 28,537) desires to secure an agency for the sale of equipment for electrical appliances. Terms, commission to be included and deducted from catalog prices. Credit, thirty or forty-five days from date of arrival of merchandise; payment by draft drawn on clients. Correspondence should be in French.

An agency is desired by a man in Australia (No. 28,557) for the sale of magnetos, self-starters, and other electrical appliances for motor cars.

South Australia, Consul Bickers reports, unlike many other countries, has not derived from the war much initiative for increasing its own manufacture. There is on this account a great scarcity of many goods. The shortage in stocks which must be replenished by importations is found, among other things, in wire and copper cable.

Albert Gimat, engineer of arts and trades, 5 Rue Lacapelle, Montauban (Laon et Garonne), France, desires connection with an American manufacturer of small electrical apparatus for a depot in France, with a shop for assembly in case shipping of detached parts is found convenient. Correspondence should be in French.

A firm in Switzerland (No. 28,570) desires to secure an agency for the sale of material and supplies for tramways and electric lighting. Correspondence should be in French.

A company in Norway (No. 28,624) desires to secure an agency for the sale of electrical fixtures. Correspondence may be in English.

A man in France (No. 28,625) desires to secure the representation of manufacturers of high-tension insulators. Correspondence should be in French.

A Belgian company (No. 28,639) desires to represent firms dealing in automobiles and trucks (electric) and all necessary accessories for electrical installations on farms, in churches and other large buildings.

A firm in Norway (No. 28,643) desires to purchase electric fixtures, electrical apparatus and supplies for light, heat and power service. An agency for these goods is also desired. Correspondence may be in English.

BRITISH GUIANA ELECTRICAL IMPORTS.—Imports of electrical apparatus into British Guiana during 1916 amounted to $18,391 and in 1917 to $26,709. Of this latter amount $25,477 came from the United States and $5,841 from the United Kingdom.

FIXTURE DEALERS MEET.—The following officers were elected for the ensuing year at the convention of the Lighting Fixture Dealers of America held on Feb. 10-11 at the William Penn Hotel, Pittsburgh, Pa.: President, C. J. Netting, Detroit, Mich.; vice-president, William L. Collines, Pittsburgh, and secretary-treasurer, Charles G. Scott, Detroit, Mich.

UNUSUAL FEATURE LINE PUBLICITY OF PHILADELPHIA JOBBERS.—The Philadelphia Electric Company, supply department, Philadelphia, is building up a set of bulletins of its lines in a way that is somewhat out of the ordinary. Instead of giving the customer a manufacturers' catalog or sending him a straight catalog list of the goods handled, this jobbing house is featuring the lines it handles by means of its own bulletins. Thus, if a line of reflectors is to be treated, a bulletin under the company's name descriptive of these reflectors is distributed, and in the bulletin all of the facts are given but in such a way as to make it easy reading. At the same time there is quite a bit of sales information showing methods of application and proper utilization. Other lines are handled similarly. The bulletins sometimes treat on only one device and at other times cover a group of devices. This supply house feels that it is building up an effective set of bulletins, which talk for it and not just for the manufacturer. At the same time it is placed in a position to furnish new customers with a comprehensive presentation of its feature lines. Furthermore, the bulletins give the house material to answer inquiries in a distinctive and personal manner.

GERMANS TO MANUFACTURE OSRAM LAMPS.—The London *Electrical Review* reports the appearance in one of the German papers of the statement that the Osram Company, Ltd., has been registered with premises at Berlin and a capital of 300,000 marks for the purpose of manufacturing electric bulbs, especially with the Osram trade mark, and other electrical technical articles.

ENGLISH DECEMBER FOREIGN TRADE.—During the month of December last there was imported into Great Britain about $300,000 worth of electrical goods and about $4,000,000 worth of machinery. This is a decrease from the preceding month of about $200,000 in electrical goods and an increase in the imports of machinery of $500,000. The exports during December last of Great Britain amounted to about $1,200,000 in electrical goods, an increase over the previous month of a little more than $250,000. The exports of machinery during that month amounted to about $5,850,000, which was a decrease of about $250,000.

GERMAN INSULATION SUBSTITUTE.—In a report by the War Trade Intelligence Department of Great Britain pertaining to metal shortage in Germany during the war and substitutes consequently employed, mention is made of a compressed paper product termed "Pertinax." This has many uses, one of which is in place of mica for insulation. Not only was this found to be cheaper than mica, it is stated, but it could be turned, stamped and drilled. It had a puncture-proof voltage of about 25,000 volts per millimeter, is unaffected by hot oil and only begins to be destroyed at about 200 deg. C. It has a tensile strength, it is said, of around 14,000 lb. per square inch and is already competing in Germany with precelain for insulation purposes.

SWEDISH ELECTRICAL MANUFACTURERS ORGANIZE.—The Electrical Industry Association of Sweden has been formed at Stockholm, for the purpose of looking out for the common interests of the industry so far as they do not concern the work of electrical contractors or such relations between employers and employees as are objects of the work of other associations. The new association will particularly look after the interests of electrical manufacturers. The association's program includes working for the electrification of industry of Sweden, watching the interests of the electrical trades from the point of view of commercial policy, striving for the standardization of electrotechnical manufacture, trying to bring about uniform forms for business agreements, etc

NEW ENGLAND WESTINGHOUSE PLANTS CLOSING DOWN.—F. N. Kollock, secretary of the New England Westinghouse Company, has announced that the Springfield and Chicopee Falls plants of the company will complete their orders and go out of business about May 1. No attempt will be made to turn the plants over to peace uses. They were originally purchased for the manufacture of rifles for the Russian government, but before the contract was completed the revolution occurred. Rifles were later produced for the British government, and after the United States entered the war the company began the manufacture of Browning machine guns for the American forces. About 2000 employees will be released from work as the orders now on the books are gradually completed.

SOUTH AFRICAN ELECTRICAL IMPORTS.—Imports of electrical goods into South Africa for 1913 and 1917, as reported by the "British and South African Export Gazette," were as given in the table below. While the total was cut about in two, the amount for the United States, as will be noticed, increased.

	1913				1917			
Principal Articles of Import	United Kingdom	United States	Germany	Total, All Countries	United Kingdom	United States	Other Principal Competitors	Total, All Countries
Electrical materials	$1,625,340	$172,775	$689,620	$2,772,185	$620,500	$352,700	$30,970	$1,302,475
Electrical machinery	709,925	255,275	1,263,730	2,256,400	408,120	303,755	33,540	751,330
Total	$2,335,265	$438,050	$1,943,350	$5,028,585	$1,028,620	$656,425	$64,510	$2,053,805

GERMANS PREPARING FOR FOREIGN TRADE.—Although peace has not been formally declared, there are many indications already that Germany is strenuously making every effort to regain her position in the foreign market for electrical goods. A report in a recent issue of the London *Electrical Review* states that the Heddern Copper & South German Cable Works Company has found little difficulty in changing over from war to peace work, the output now being fine rather than coarse work. The directors of Voigt and Haeffner A. G. of Frankfort-on-Main state that, although a large number of army orders have been canceled, the transition to peace work has been easily completed owing to the urgent demand for the company's products by central stations. In addition, there is a demand, the report states, from Holland, Switzerland and Scandinavia, although this business is endangered through interference of the Allies with the German export trade.

AMERICANS ABROAD TO ASSIST AMERICAN FOREIGN TRADE.—As part of a broad plan to stimulate the effective development of the country's export trade the American Manufacturers' Export Association announces that it is linking up the organization in this country with American chambers of commerce in other countries. The first step in this direction was taken at a recent conference between G. M. Cassatt, president of the American Chamber of Commerce in London, and George E. Smith, president of the Export Association, when arrangements were completed whereby the two organizations will coöperate in a definite and practical way. The London chamber receives a great many inquiries from British importers which require investigation in the United States. The Export Association will undertake to render this service, while, on the other hand, the London organization will perform a like service by answering inquiries from America regarding local conditions, credit matters and special trade opportunities in England. In discussing this coöperative plan, Mr. Cassatt declared that American chambers of commerce abroad are in a particularly advantageous position to assist American manufacturers and exporters in developing their foreign markets.

FAR EASTERN MARKETS FOR AMERICAN ELECTRICAL GOODS.—So great is the demand for telephone installations in Japan that when a subscriber is willing to give up his telephone he sells it through a broker, there being a regular market value of from $250 to $750, according to a bulletin issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce. Japan, it appears, has shown a wonderful electrical growth in the last ten or fifteen years, as there are now nearly 700 central station systems, 530 electric power and light systems, 42 electric tramways and 48 combined railway and lighting systems, together with 1609 private and 53 government-owned plants. In 1915 there were 3,051,925 families using electric light, and in the fall of 1917 there were 152,000 subscribers awaiting the installation of telephone apparatus, some of them having waited for more than ten years. In December of that year there were to be some installations made from among the 4000 "urgency applications," but only 300 of them were made and some of these not until the March following. In recent years Japan has changed from an exclusively importing to an exporting country and has established its own electrical goods industry. It is now a strong competitor in some lines in its own markets instead of being solely a consumer of imported goods. In 1916, says Trade Commissioner R. A. Lundquist, author of the report, there were imported into China electrical goods to the amount of approximately $4,000,000. This, in connection with the fact that the Chinese people have developed a progressive tendency and their great population and increasing purchasing power, indicates an important future demand for electrical goods. The bureau's bulletin gives a good idea of the climate, customs of the people, conduct of trade, business methods and many other matters having a direct or indirect bearing on the electrical goods

business. Copies of "Electrical Goods in China, Japan and Vladivostok," Special Agents' Series No. 172, can be obtained at 20 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C., or from any district or coöperative office of the Bureau of Foreign and Domestic Commerce.

WESTINGHOUSE, CHURCH, KERR & COMPANY opened a Southwestern headquarters for negotiating and engineering in Dallas, Tex., about Feb. 1. The offices are in the Western Indemnity Building, and A. W. Nichols is in charge.

THE BODINE ELECTRIC COMPANY, Chicago, has with the February number commenced the publication of a new house organ called the *Motorgram*. This is a monthly publication, mostly about motors in the small sizes, published for those interested in motor problems and new developments in the industry.

ROY E. SCHAULIN, who recently became manager of the Chicago division of the American Appliance Company, distributers of electric incandescent lamps, has been continuously engaged in sales work in the electrical field for more than twenty years. Mr. Schaulin's first work

R. E. SCHAULIN

in the electrical field was with the Sawyer-Man Electric Company, beginning in 1898. Three years later he went with the Westinghouse Electric & Manufacturing Company, Pittsburgh, to sell lamps and appliances. After nine years in that position he was employed by the Westinghouse Lamp Company of Bloomfield, N. J., as special representative for one year, after which he returned to the parent company (Pittsburgh) as manager of the lamp division. In the latter part of 1912 he was transferred to the company's Chicago office, and in 1913 he was again transferred to the New York office of the Westinghouse Lamp Company, where he had charge of lamp sales to central-station syndicates. Late in the year 1913 he joined the advertising sales forces of the ELECTRICAL WORLD in Chicago, where he remained until Nov. 1, 1914, when he was transferred to the New York office. Resigning that position on Sept. 1, 1916, Mr. Schaulin was made district manager of the Franklin Electric Manufacturing Company, New York, where he remained until that concern was purchased by the Westinghouse Lamp Company on Feb. 1. He was first tribune of the Jovian Order in New York in 1917.

N. M. HARALSON, who has been connected with the Bureau of Aircraft Production for the past seventeen months and since June, 1918 has been chief of the section of instruments and armament, New York office, has resigned his position with the bureau and has taken charge of the Atlanta branch of the Haralson Sales Company, Inc., headquarters being in Birmingham. Mr. Haralson was formerly connected with the engineering and sales departments of the General Electric Company at New Orleans and the Westinghouse Electric & Manufacturing Company at Philadelphia.

JAMES W. THOMPSON has been appointed manager of the electrical department for the H. W. Johns-Manville Company of San Francisco, succeeding Sam Russell.

THE ELECTRICAL ENGINEERS' EQUIPMENT COMPANY'S Salt Lake City office, which is in charge of Arthur Purdon, has been moved from 218 Judge Building to 1119 Boston Building, Salt Lake City.

R. J. DEARBORN has recently withdrawn from the patent-law firm of Marshall & Dearborn, 160 Broadway, New York City. Mr. Marshall has arranged to continue the entire general patent and trademark practice of the old firm at the old address.

THE AMERICAN IRONING MACHINE COMPANY of Chicago, manufacturer of motor-driven ironers, is making arrangements to establish a Western warehouse in San Francisco for Pacific Coast distribution. The company has a branch now in San Francisco and another in Oakland, Cal., with H. R. Basford as Pacific Coast representative.

THE FRANKLIN ELECTRIC MANUFACTURING COMPANY, which was recently taken over by the Westinghouse Lamp Company, has consolidated its district office with that of the latter company at 165 Broadway. W. W. Briggs, district manager of the Westinghouse Lamp Company, is also district manager of the Franklin Electric Manufacturing Company.

THE EDISON ELECTRIC APPLIANCE COMPANY of Chicago, it was announced by President George A. Hughes before a recent meeting of electrical contractors, is planning to add to its line this year a motor-driven sewing machine and a vacuum cleaner. It is expected also to work out a standard Edison plug and to equip all but nine devices of its manufacture with this plug.

THE HOOVER SUCTION SWEEPER COMPANY, of North Canton, Ohio, has acquired the adjoining plant of the W. H. Hoover Company, manufacturer of leather goods. This line will be discontinued. The additional capacity, it is understood, will be used by the cleaner company to manufacture some of the motors used in its cleaners. It is the intention of the company later, it is reported, to enlarge the plant and then manufacture all motors required.

THE REMY ELECTRIC COMPANY, Anderson, Ind., manufacturer of automobile accessories, which for the past five years has been affiliated with the United Motors Corporation, it is reported, has now become a subsidiary of the General Motors Company. So far as can be learned, no change in present operations is planned. It is proposed at a later date to erect an administration building at the local works and to move the present office and laboratory at Detroit to this location.

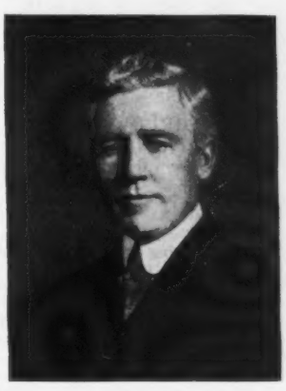
THE EDISON LAMP WORKS OF GENERAL ELECTRIC COMPANY are announcing a new plan for the distribution of window-display material. In the future, instead of offering dealers and agents separate pieces of display matter to be shipped from the factory, they will have prepared a special assortment with full instructions for its proper use carefully packed in a flat cardboard container which the agent can obtain promptly upon request sent to the district sales office. This assortment will be uniform for a given period, at the end of which time a new assortment will be issued in order that the agent may have fresh and new material to use throughout the year.

THE FACTORY PRODUCTS CORPORATION, successor to the Factory Products Export Corporation, has been incorporated and its offices have been removed from 61 Broadway to 2 Rector Street, New York City. The corporation has already established export and import relations in the Argentine, Chile, Ecuador, Venezuela, Mexico, the British West Indies, China, India, the Philippines, the Straits Settlements and the Dutch East Indies. The Factory Products Corporation announces its association with the Engineers' Corporation, a subsidiary of the J. G. White Engineering Corporation, for the export of machinery and contractors' and builders' supplies. The corporation's principal trade, so far, has been built up in textile and general exports to the River Plate, general merchandise to the Far East and to the northern end of South America, and in importations from Venezuela. Ten resident agencies have been established also in the principal trading cities of the Far East.

E. M. HAIG, factory representative on the Pacific Coast of the Manhattan Electrical Supply Company, is now at 1629 Harvard Avenue, Seattle, Wash., instead of 604 Mission Street, San Francisco, Cal.

J. CORBUS BUSHNELL, formerly associated with the Business Men's Clearing House, Chicago, and until recently connected with the United States Employment Service as special agent to examine the personnel methods in vogue at Vickers, Ltd., and the Woolworth Arsenal, England, has been engaged by the General Engineering Agency, Pittsburgh, Pa., as personal director.

THE WELLMAN-SEAVER-MORGAN COMPANY, at the annual meeting of the stockholders on Feb. 18, re-elected for the current year the retiring board of directors. At the annual meeting of the board, immediately after the meeting of the stockholders, the following officers were elected: Edwin S. Church, president and general manager; S. H. Pitkin, vice-president; George W. Burrell, second vice-president; W. H. Cowell, secretary and treasurer. G. W. Burrell, who was elected second vice-president, has been in the continuous employ of the company for twenty-one years. He will have entire charge of the company's works both at Cleveland and Akron. He was born in 1871 and was graduated from the Ohio State University in 1891 in me-



G. W. BURRELL

chanical engineering. He entered the employ of the Wellman-Seaver-Morgan Company in 1898 and has worked his way up from draftsman.

C. W. JOHNSON has been appointed assistant manager of works of the Westinghouse Electric & Manufacturing Company. After graduating from Ohio State University, Mr. Johnson entered the employ of the Steel Motor Company of Johnstown, Pa. A year later he became associated with the Bullock Electric Company, Cincinnati, Ohio, and in 1904 was made superintendent of the Allis Chalmers Bullock, Ltd., Montreal, Canada. In 1907 he entered the employ of the Westinghouse company, being appointed chief inspector of works, later being promoted to general superintendent, in which capacity he served until his recent appointment.

THE PERSIAN-AMERICAN COMMERCIAL CORPORATION, capitalized at $20,000,000, has been formed for the development of Persian-American trade, as the indirect outcome of an address delivered late in December in Newark by the Persian Minister to the United States, Dr. Mirza Ali Kula Kahn. Dr. Kahn has been elected vice-president of the corporation, which is headed by Warren C. King, president of the Manufacturers' Council of the State of New Jersey. The corporation will send to Paris a number of Persians who have long been resident in the United States, together with a number of American engineers and experts, to establish branches of the corporation. A large consignment of American products is expected to leave this country in April. Speaking of the corporation Mr. King says: "The corporation expects to develop the water supply as well as the supply of gas and electricity to the principal cities of the Empire. Persia has a population of about 15,000,000 and is three times the size of France."

Trade Publications

CHAIN DRIVE.—Small power drives are illustrated in publication No. 16 from the Morse Chain Company, Ithaca, N. Y.

OSCILLOGRAPH. — H. G. Crane of Brookline, Mass., has issued a forty-two-page booklet containing detailed information about his lecture-room oscillograph.

TRUCKS AND TRACTORS.—Catalog No. 19 has been prepared by the Walker Vehicle Company of Chicago to describe its balanced-drive electric trucks and tractors for road use.

LIGHTING FIXTURES.—The Charles Polacheck & Brother Company, Milwaukee, Wis., has issued an eight-page supplement, No. 26, illustrating some advanced designs from its new general catalog No. 27, which will be ready for distribution in the spring.

FANS.—A folder about fan advertising matter for dealers has been issued by the Robbins & Myers Company, Springfield, Ohio. Two circulars, one about ceiling fans and the other about desk and wall fans, have also been prepared for distribution by dealers.

ELECTRIC SPECIALTIES.—The C. D. Wood Electric Company, 441 Broadway, New York City, will shortly have ready for distribution a new catalog listing and illustrating the items it markets. These include switches, flashlamps, lamps, porcelain receptacles and batteries.

TELEPHONE SWITCHBOARDS.—Bulletin No. 1021 of thirty-three pages from the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., contains reading matter and illustrations about its private-branch exchange switchboards.

INDOOR BUS SUPPORTS.—The Delta-Star Electric Company, 2433 Fulton Street, Chicago, has issued an addenda bulletin No. 31-A, describing unit-type busbar supports with adjustable fittings for use with round busbars. This leaflet supplements bulletin No. 31.

WIRING DEVICES.—The Cutler-Hammer Manufacturing Company of Milwaukee is distributing the 1919 edition of its wiring devices catalog written in Spanish. It lists and illustrates the majority of the C-H wiring devices shown in the 1919 English catalog and comprises twenty-four pages, being intended for distribution to the Central and South American trade.

TRANSMISSION LINE AND ELECTRIC RAILWAY EQUIPMENT. — Containing more than 600 pages, catalog No. 17, dated 1919, has been published by the Ohio Brass Company of Mansfield, Ohio, to cover its line of appliances used in the construction, maintenance and operation of electric railway, mine haulage systems and transmission lines. It is well bound in cloth, printed on coated paper, very well illustrated and has thumb indexes for eight sections of the catalog. The titles of these are: "Porcelain Insulators," "Pole Hardware and Miscellaneous Materials," "Trolley Materials," "Catenary Materials," "Rails, Bonds and Tools," "Third-Rail Insulators," "Car Equipment Materials," and "Tables, Data and Indexes."

New Incorporations

THE MUTUAL LIGHT & POWER COMPANY of Milan, Ohio, has been incorporated with a capital stock of $10,000 by J. O. Drake, George Mason, A. G. Odell, Fred J. Boose and Prescott Milliman.

PREBLE (IND.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $8,000. The directors are: James A. Steele, Albert Huser, Charles Arnold, William Beineke, O. Adler and William M. Meyer.

THE CALIFON (N. J.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by J. B. Apgar, Kinzie Apgar and L. M. Apgar, all of Califon. The company is capitalized at $100,000 and proposes to generate and distribute electricity.

THE WARRENTON (VA.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $50,000 to operate an electric light and power plant. The officers are: James O'Connell, of Washington, D. C., president, and J. M. O'Connell of Warrenton, secretary.

THE GREAT SOUTHWEST POWER & DEVELOPMENT COMPANY of Wilmington, Del., has filed articles of incorporation with a capital stock of $1,000,000 and proposes to control, operate and develop water and power rights, plants, etc. M. L. Horty, M. C. King, S. L. Mackey of Wilmington are local incorporators.

New England States

WEST POWNALL, ME.—Arrangements are being made by the board of managers of the Home for Feeble-Minded for the erection of a new power plant, 53 ft. by 72 ft., at the institution, to cost about $69,500.

BROOKLINE, MASS.—Estimates are being received by the Christian Science Benevolent Association of Boston for a group of buildings to be erected at Brookline, including a power house, 70 ft. by 120 ft.

PAXTON, MASS.—Plans have been approved by the Town Council for extensions to the street lighting system.

WESTFIELD, MASS.—The installation of a new fire-alarm system is under consideration by the Town Council.

PROVIDENCE, R. I.—Work has begun on the proposed new turbine house to be erected by the United States Finishing Company, to cost about $25,000.

CHESHIRE, CONN.—An appropriation of $80,000 has been voted by the State Legislature for the construction of a factory at the Cheshire Reformatory for Boys.

STAMFORD, CONN.—The Stamford Extract Manufacturing Company is planning to rebuild its manufacturing plant recently destroyed by fire. The loss is estimated at about $900,000.

Middle Atlantic States

ALFRED, N. Y.—The installation of an electric lighting system in Alfred is under consideration by the Town Council.

BUFFALO, N. Y.—The Public Service Commission has authorized the merger of the Buffalo General Electric Company with the General Transmission Company of Buffalo.

KINGS PARK, N. Y.—Plans are under consideration by the board of managers of the Kings Park State Hospital for the completion of improvements now under way in the electric lighting system at the institution and the installation of outside electric lighting units, to cost about $18,000. The board, it is understood, is also considering plans for rewiring of buildings A, B, C and D at the institution, to cost about $18,000. Application has been made to the State Legislature for appropriations to cover the cost of the work.

NEW YORK, N. Y.—Plans have been prepared by F. J. Bird, architect, 101 Park Avenue, for the erection of a garage on Fifty-fourth Street near Eighth Avenue, for the Buick Auto Repair Shop, 244 West Forty-ninth Street, to cost about $400,000.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Room 2800, Municipal Building, New York City, until March 17 for, Item 9, passenger elevators, and Item 10, electric-ash hoists of the mechanical equipment in Evander Childs High School, East 184th Street and Field Place. Separate bids to be submitted for each item. Blank forms, plans and specifications may be obtained at the temporary estimating room, Brooklyn Branch of Board of Education, 131 Livingston Street, Brooklyn.

OGDENSBURG, N. Y.—Application has been made to the State Legislature by the board of managers of the St. Lawrence State Hospital for an appropriation to provide for the installation of additional boiler equipment and new mechanical laundry equipment. The cost is estimated at about $68,000. R. H. Hutchins is superintendent.

RICHMOND HILL, N. Y.—Initial steps have been taken by the Richmond Hill Business Men's Association for the organization of an independent company to furnish electricity in the Richmond Hill section.

SONYEA, N. Y.—The contract for electrical work in connection with the construction of new buildings at the Craig Colony for Epileptics, Sonyea, has been awarded to A. J. Beuerlein of Mount Morris.

TOTTENVILLE, N. Y.—The Richmond Light & Railroad Company has recently completed the erection of a 6600-volt new transmission line from its power plant at Livingston to Tottenville, and is now making arrangements for the installation of transformers and auxiliary equipment at its local substation. The company is now installing a new booster station in the Arthur Kill Road.

WATERTOWN, N. Y.—The Northern New York Utilities, Inc., is reported to be considering a water power development at Brown's Falls. The plans include construction of dam, power house, flume and tailrace on Oswegatchie River. J. B. Taylor is president.

WATERTOWN, N. Y.—Options have been obtained by the Northern New York Utilities, Inc., Light & Power Building, on land along the north bank of Black River for a proposed interurban electric railway connecting Watertown with Vincent, passing through Glen Park, Brownville, Dexter, Chaumont, Three Mile Bay, Rosier and Cape Vincent, a distance of 30 miles. J. B. Taylor is president.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

WATERTOWN, N. Y.—Plans are under way by the New York Air Brake Company, Starbuck Avenue, the Northern New York Utilities Inc., Light & Power Building, J. B. Wise, 401 Mill Street, and associates to charter a company under the name of the Beebe Island Corporation to develop a water power in Watertown. The proposed project includes power house, concrete dam, flumes and tailraces, installation of 7500-hp. generating units, etc. The cost is estimated at about $500,000.

DOVER, N. J.—The New Jersey Power & Light Company is negotiating with Roxbury Township for street lighting. Roxbury Township comprises Succasunna, Ledgewood and Kenvil. The communities have appropriated $3,000 per year for street lighting.

NEWARK, N. J.—Plans are being prepared by the Board of Freeholders for the installation of electrical equipment for the operation of the Avondale drawbridge across the Passaic River.

POMPTON LAKES, N. J.—Work has begun on the construction of the addition to the municipal hydroelectric plant.

TRENTON, N. J.—Plans are under consideration by the City Council for extensions and improvements to the electric street-lighting system in the North Trenton section.

TRENTON, N. J.—Arrangements, it is reported, are being made by the Mercer County Traction Corporation for an extension of its traction system to begin at the Market Street division and extend to the municipal dock at a cost of about $80,000.

WHITEHOUSE, N. J.—Plans are under consideration by the Town Committee for the installation of a new municipal electric light plant to furnish service at Whitehouse Station, East Whitehouse, Lebanon and Oldwick.

ALLENTOWN, PA.—Plans are under consideration by the city officials for extensions and improvements in the electric cable system.

BEAVER FALLS, PA.—Plans are under consideration by the Beaver County Light Company for the installation of a new electric lighting system in Beaver Falls. The present contract calls for 123 arc lamps, 41 lamps of 80 cp., 2 of 40 cp. and 2 of 60 candlepower.

HANOVER, PA.—Plans have been prepared by the Hanover Light, Heat & Power Company for the installation of a 1000-kw. turbo-generator and surface condenser with a suitable spray cooling system. Revamping of certain existing distribution lines by raising the voltage to 13,000 volts is also under consideration. A new switchboard is now being installed to meet the requirements of the new plant.

HERSHEY, PA.—Plans have been completed for a new factory and power plant addition at the works of the Hershey Chocolate Company.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 17, for two 15-ton electric traveling bridge cranes for the navy yard at Philadelphia, to cost about $70,000.

PITTSBURGH, PA.—Plans are under consideration by the City Council for the construction of a new crosstown traction system, to be operated from the Southside district to Millvale.

PITTSBURGH, PA.—Contract has been awarded by the Duquesne Light Company for the construction of an addition to the machine shop at its power station on Brunots Island to D. T. Riffle, Keenan Building, Pittsburgh.

READING, PA.—The Carpenter Steel Company has taken out a permit for the construction of a power house to be erected on the west side of the Schuylkill River, between the river and Schuylkill Avenue and Glenside. The cost is estimated at $90,000.

SCRANTON, PA.—If approved by the City Council the Board of Trade will erect a factory incubator on the city viaduct property on Lackawanna Avenue, to cost about $500,000. Preliminary plans call for a concrete and steel building, equipped with a power and lighting plant.

WILSON, PA.—Plans are under consideration by the City Council for extensions and improvements to the police and fire-alarm systems.

MILFORD, DEL.—A bill has been passed by the State Legislature allowing the town of Milford to appropriate $20,000 for extensions and improvements to the municipal electric plant and waterworks system.

BALTIMORE, MD.—Plans are being prepared by the Canton Air Brake Company, Calvert Building, for the construction of a plant, the first unit to cost about $180,000. The ultimate cost is placed at $1,000,000. R. Schoenwetter and C. A. Zarobsky, Calvert Building, are engineers.

BALTIMORE, MD.—The Bartlett Haywood Company and the Furst Realty Company of Baltimore, it is reported, have formed a combination for the purpose of building a large ship repair plant at Fort McHenry, where a site of about 100 acres has been acquired. The plans provide for the construction of a large dry dock, machine shops, foundry and miscellanecus buildings equipped with electric traveling cranes and complete marine railroad system encircling the works. The cost of the entire work, including dredging harbor, is estimated at about $4,000,000.

CENTERVILLE, MD.—Plans are under consideration to extend the municipal electric lighting service to Queenstown. This extension would be made by the Town Commissioners of Queenstown to secure electricity from the local municipal electric plant. If the project goes through two 15-kva., 6600/220/110-volt, 60-cycle, single-phase transformers, 6½ miles of No. 8 hard-drawn bare copper wire, insulators and 320 poles will be required. About sixty 5-amp. and 10-amp. house meters will also be required by the Queenstown Commissioners. L. D. Shank is manager of the municipal electric plant.

MIDDLETOWN, MD.—The Middletown Packing Company is planning to equip its proposed canning plant with electrically operated machinery. E. A. Toms is secretary.

CHARLESTON, W. VA.—Arrangements are being made by the Virginia Power Company for extensions to its system in Cabin Creek Junction.

HUNTINGTON, W. VA.—Plans are under consideration by the Chesapeake & Ohio Railroad Company for extensions and improvements to its local shops, to cost about $500,000. F. I. Cabell of Richmond, Va., is chief engineer.

SWISS, W. VA.—The Kanawha Collieries Company is contemplating the installation of an electric power plant (to develop from 200 hp. to 400 hp.), in connection with the developments of 1200 acres of coal lands. Harold P. Tompkins of Charleston is general manager and engineer.

NORFOLK, VA.—The proposed new plant to be established by the Norfolk Glass Manufacturing Company will include power house, boiler house, machine shop, etc.

WASHINGTON, D. C.—Bids will be received by the Machinery and Engineering Materials Division, Room 2641, Munitions Building, Washington, D. C., until March 18, under M.E. circular No. 3, for furnishing 87,760 ft. cable, submarine type 327, Signal Corps specification 427-M.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Room 511, District Building, Washington, D. C., until April 3, for furnishing and delivering during the fiscal year beginning July 1, 1919, and ending June 30, 1920, electrical supplies, etc., for use for the various branches of the government of the District of Columbia. Form of proposal, specifications, etc., may be obtained from the purchasing officer, room 320, District Building.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 1, for furnishing for Charleston, under Schedule 3855, machine tools, electric drills, engine lathe, milling and grinding machine. Bids will also be received until March 21 for furnishing for Alexandria, Va., under Schedule 7856½—miscellaneous lead-covered cable, 5000 ft. of No. 16 lamp cord and miscellaneous copper wire. Application for proposal blanks should give the schedule desired by number.

North Central States

MILFORD, MICH.—The development of two water powers during the coming season is under consideration by the Milford Electric Company.

MULLIKEN, MICH.—An election will soon be held to vote on the purchase of the electric plant of the Mulliken Electric Company to be owned and operated by the municipality.

PECK, MICH.—The City Council is considering the establishment of a municipal electric light plant.

TRAVERSE CITY, MICH.—The City Council is considering the purchase of 200 acres of additional land to be used for flowage purposes in the erection of additional dam facilities in connection with the municipal electric light plant.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until March 21 for transformers for the division of light and heat. Bids will also be received at the same time and place for service switches for the division of light and heat. Specifications may be obtained upon application to Room 204, City Hall.

COSHOCTON, OHIO.—The Ohio Service Company is installing an additional 4000-kw. at its plant in New Philadelphia and is contemplating the installation of a new switchboard at its Dennison substation, and also the erection of a parallel circuit of 33,000-volt transmission lines from New Philadelphia to Dennison and from Newcomerstown to Cambridge. C. W. Howell of Coshocton is manager.

MARTIN'S FERRY, OHIO.—A special report submitted to the Council by John W. Tush, superintendent of the municipal electric light plant recommends the installation of an emergency boiler at once, and also the consolidation of the electric light and waterworks plants.

ORWELL, OHIO.—The Town Council is considering establishing a municipal electric light plant in Orwell.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company contemplates extensions and improvements to its plant, involving an expenditure of about $20,000.

CARBON, IND.—Arrangements are being made for the installation of an electric lighting system in Carbon.

GOSHEN, IND.—The capital stock of the Hawks Electric Company of Goshen has been increased from $200,000 to $300,000.

INDIANAPIOLS, IND.—The Public Grain & Elevator Company is planning to erect a grain elevator with a capacity of 500,000 bushels. The company will also remodel its mill at Edinburg and install new machinery.

LOOGOOTEE, IND.—The city of Loogootee has purchased the local electric light plant for $7000.

TELL CITY, IND.—The Tell City Water & Light Company has petitioned the Public Service Commission for permission to sell $16,000 in capital stock. A number of improvements are contemplated by the company.

BISMARCK, ILL.—The Alvin (Ill.) Grain & Electric Company is contemplating the construction of a new electric light and power plant in Bismarck.

BLUE ISLAND, ILL.—The American Wire Fabrics Company, 208 South La Salle Street, Chicago, has purchased a site near Blue Island on which it proposes to erect a plant to cost about $1,000,000.

CHICAGO, ILL.—Bids, it is understood, will soon be asked by Fridstein & Company, engineers, 53 West Jackson Boulevard Chicago, for the extensions to the plant of the Vitanola Talking Company, 503 Thirty-fifth Street, Chicago, to cost about $250,000.

CHICAGO, ILL.—Marshall Field & Company have purchased a factory building at West Forty-seventh and Whipple Street, which will be equipped for the manufacture of burlap bags. The proposed plant will be equipped with electrically operated machinery.

FARMINGTON, ILL.—The Central Illinois Light Company of Peoria has petitioned the Public Utilities Commission for permission to erect a 13,000-volt transmission line from Farmington to Gilchrist, a distance of 9 miles.

MOUNT VERNON, ILL.—Extensions and improvements are contemplated by the Citizens' Gas, Electric & Heating Company, including the installation of a 450-kva. generating unit. Frank M. Stone is manager.

NAUVOO, ILL.—The Nauvoo Electric Light Company has petitioned the Public Utilities Commission for permission to issue $10,000 in bonds.

NEW ATHENS, ILL.—Work has begun on rebuilding the power house of the New Athens Power Company. The mill was recently damaged by fire and considerable damage was done to the machinery.

ROCK ISLAND, ILL.—The Universal Tractor Company, affiliated with the Moline (Ill.) Plow Company, is planning to build a plant on Forty-second Street and Third Avenue, to cost about $250,000. Plans are being prepared by J. D. Clark, engineer, care the Moline (Ill.) Plow Company.

WELDON, ILL.—The installation of an electric lighting system to cost about $15,000, is reported to be under consideration by the Town Board.

WINNETKA, ILL.—The Village Council is considering plans for placing all overhead electric lighting and telephone wires in conduits within the village limits.

MILWAUKEE, WIS.—Bids will be received by the Robert A. Johnston Company, 270 Florida Street, Milwaukee, for the construction and equipment of a factory, 135 ft. by 310 ft., seven stories, for the manufacture of candy and biscuits. The plans provide for a separate steam generating plant, 40 ft. by 90 ft. The cost of the project is estimated at $750,000. Herman J. Esser, Camp Building, Milwaukee, is architect.

SHELLY, MINN.—Contract has been awarded for the installation of an electric light plant in Shelly. Thomas T. Johnson is owner and manager of the plant.

BOONE, IOWA.—The Boone County Telephone Company contemplates an expenditure of from $25,000 to $30,000 for improvements to its lines.

MAQUOKETA, IOWA.—We are informed that the construction of a high-tension transmission line between Anamosa and Maquoketa has been in process of construction for a year and a half. An item published in the issue of Feb. 15 stated that the Iowa Electric Company was contemplating the erection of a transmission line to connect the hydroelectric plant in Anamosa with the steam generating plant in Maquoketa.

SIOUX FALLS, IOWA.—Work, it is understood, will soon be started on the erection of a 60,000-volt electric transmission line to connect the Sioux Falls division of the Northern States Power Company with the company's transmission system in southwestern Minnesota, between Pipestone and Dell Rapids, a distance of 35 miles. A new 3500-kw. steam turbine will be installed at the Sioux Falls power house to take care of the increased loads, which will be secured over the new line.

WASHINGTON, IOWA.—The Iowa Gas & Electric Company is contemplating extending its electric transmission line into the rural districts, a distance of 7 miles.

CABOOL, MO.—Bonds to the amount of $10,000 have been authorized to purchase the local electric light plant, owned by John Bauck.

CLARKSVILLE, MO.—Sufficient money, it is understood, has been raised for the installation of a municipal electric light plant in Clarksville.

KANSAS CITY, MO.—The Quality Ice & Storage Company is contemplating equipping a power plant. Tair & Nordmayer of St. Louis, Mo., are engineers. A. L. Williams is secretary.

MARSHALL, MO.—Bids will be received by the city of Marshall until March 28 for the installation of a steam power plant and electric transmission system in Marshall. Specifications may be obtained from the Henrici-Lowry Engineering Company, 222 Commerce Trust Building, Kansas City, Mo., upon deposit of $10.

MACON, MO.—Bids will be received by W. H. Martin, city clerk, Macon, until April 2 for improvements to municipal electric light plant, including the installation of one 400-kva. to 500-kva. generator directly connected to steam engine with condensing equipment, spray pond or cooling tower and switchboard. For details see Searchlight Section.

ST. JAMES, MO.—Plans are under consideration for extensions and improvements to the Missouri State Soldiers' Home, including additions to existing hospital, to cost $20,000; miscellaneous additions, $20,000; elevators, $3,500; new power house equipment, $7,600; septic tank, etc., $8,000. W. V. Farris is president board of managers.

VALLEY CITY, N. D.—Bids, it is understood, will soon be called by the Board of Control for electric lighting plants for the various State institutions. E. G. Wanner is secretary.

HAYTI, S. D.—At a special election held recently the voters authorized an issue of bonds to purchase the local electric light plant owned by S. Abrahamson.

HERRICK, S. D.—Preliminary plans are being prepared by the Henningson Engineering Company, National Bank Building, Omaha, Neb., for improvements to the municipal electric light plant and waterworks system. An election will soon be held to submit a bond issue to the voters to provide funds for the work.

OMAHA, NEB.—A bill has been introduced in the Legislature to appropriate $120,000 for improvements to the University of Nebraska College of Medicine, Forty-second Street and Dewey Avenue, to be used as follows: $40,000 for electrical apparatus, laboratory equipment, assembly room, elevator, etc; $80,000 for erection of heating plant, including chimney stack, water tube boilers, etc. J. Latenser & Sons, Bee Building, are architects.

STERLING, NEB.—Bids, it is understood, will soon be asked by the city of Sterling for the erection of an electric transmission line from Tecumseh to Sterling. Material has already been purchased. Grant & Fulton, Bankers' Life Building, Lincoln, are engineers.

ALTAMONT, KAN.—Plans are being prepared by Archer & Stevens, New England Building, Kansas City, Mo., engineers, for an electric light plant in Altamont. An election will soon be held to vote on the proposal to issue $25,000 in bonds to install the proposed plant.

MORGANVILLE, KAN.—The question of installing an electric lighting system in Morganville is being agitated. L. D. Huff is city clerk.

SYLVIA, KAN.—The towns of Sylvia and Lewis are considering the installation of a new lighting plant.

Southern States

AUGUSTA, GA.—The City Council is considering the installation of an electric lighting system.

PENSACOLA, FLA.—The Pensacola Electric Company, it is reported, is contemplating improvements to its plant and the purchase of additional equipment.

FLORENCE, ALA.—The City Council has engaged Evans & Brown, engineers, to prepare plans for a municipal electric light plant.

SELMA, ALA.—The installation of an electric light plant is reported to be under consideration by the City Council.

JACKSON, MISS.—Negotiations are under way between the city officials and the representatives of the Jackson Light & Traction Company in regard to improvements to the company's plant and service. The cost of the proposed improvements is estimated at from $100,000 to $150,000.

NATCHEZ, MISS.—The proposal to establish a municipal electric light and power plant will be submitted to the voters.

MENA, ARK.—Arrangements have been completed by the borough officials for the installation of an ornamental lighting system on two of the principal thoroughfares of the borough.

NASHVILLE, ARK.—The Nashville Light Company is reported to be considering extending its electric transmission line to Mineral Springs, a distance of 8 miles.

KAPLAN, LA.—Plans are being prepared by X. A. Kramer, engineer, Magnolia, for a municipal electric light plant and water works system in Kaplan.

CUSHING, OKLA.—The Minnesota Electric & Power Company is contemplating the installation of an ornamental lighting system in the business district of Cushing.

DEWEY, OKLA.—The installation of a municipal electric light plant in Dewey is under consideration.

FREDERICK, OKLA.—Plans are being prepared for improvements for the municipal electric light plant. The installation of an ornamental lighting system on Grand Avenue is also under consideration.

NEWKIRK, OKLA.—Plans are being prepared for reconstruction of the municipal electric light plant and water works system.

MUSKOGEE, OKLA.—Work, it is understood, will begin at once by the Muskogee Gas & Electric Company, subsidiary of H. M. Byllesby & Company of Chicago, Ill., on the erection of an electric transmission line from Muskogee to Drumright, traversing the heart of the eastern Oklahoma oil field and touching several large towns.

Pacific and Mountain States

COLFAX, WASH.—The City Council is considering the installation of a municipal electric light plant to furnish electricity for street lighting and pumping water to the reservoir.

SEATTLE, WASH.—The City Council has appropriated $20,000 for repairs to the Cedar River power plant pipe line and $15,000 for Light Department construction work.

ASTORIA, ORE.—Plans are being prepared by the Pacific Power & Light Company for the erection of a 4500-hp. electric generating plant adjoining its present plant on Astor Street. Additional power is required to supply service to the proposed new 3000-barrel flour mill of the Astor Flouring Mill Company and for the extension of the Astoria Marine Iron Works.

NORTH BEND, ORE.—The Mountain States Power Company, it is reported, is arranging for the removal of its power plant from Marshfield to North Bend. Until recently the plant has been operated in conjunction with the lumber mill of the C. A. Smith Lumber Company. The closing down of the mill has necessitated the removal of the plant or the installation of boilers and equipment. When the plant is removed new machinery will be installed.

LONG BEACH, CAL.—The City Council is considering the construction of a municipal electric light plant and purchasing the local distribution system of the Southern California Edison Company. D. S. Miller is city engineer.

SAN FRANCISCO, CAL.—The managers of the Letterman General Hospital is considering the construction of a new electric power plant, to cost about $60,000.

SAN FRANCISCO, CAL.—The Great Western Power Company has petitioned the State Railroad Commission for permission to reorganize the company and to build a hydroelectric plant on the North Fork River to cost about $5,000,000. The plans provides for the organization of a new company to be known as the Great Western Power Company of California, which is to take over the holdings of the Great Western Power Company, the City Electric Company and the Consolidated Power Company. The proposed development is to be located in the main canyon of the North Fork, six miles from Belden station. The spillway at Big Meadows dam (Lake Almanor) will be raised nine feet and the capacity of the reservoir increased from 300,000 acre feet to 380,000 acre feet. The power plant will be equipped with two 20,000-kw. generating units, together with necessary electrical apparatus for switching and stepping up energy to the transmission voltage. Ultimately the plant will be increased to 136,000 kw. From the power house a 150,000-volt steel tower transmission line will carry power to Big Bend and thence to Valona substation, a distribution center on the shore of San Francisco Bay south of Carquinez Straits. A nine-mile standard gage railroad will be built from the Western Pacific Railway to the plant site to deliver machinery and material. Water rights, land, etc. have already been obtained by the Great Western Power Company.

MOSCOW, IDAHO—A committee has been appointed by the City Council to investigate the feasibility of installing a municipal electric light plant in Moscow.

PAROWAN, UTAH.—Application has been filed with George F. McGonagle, state engineer, by John L. Lowden of Parowan for permission to use 10 second-feet of water to be taken from Parogonah Creek in Iron County. The power is to be utilized to generate electricity.

CUT BANK, MONT.—John Seal & Son have been granted a franchise to construct and operate an electric light plant in Cut Bank for a period of twenty-five years. It is expected to have at least one of the units in operation within sixty or ninety days.

WHITEFISH, MONT.—The City Council has appointed a committee to make investigations as to the feasibility of establishing a municipal electric light plant in Whitefish.

BRECKENRIDGE, COL.—The installation of an electric light plant is under consideration by the city of Breckenridge.

CRAIG, COL.—Work will begin on the construction of the proposed new electric light plant as soon as the frost is out of the ground. Mr. Dutcher will have charge of the work.

CROOK, COL.—An election will soon be held to vote on the proposal to issue $20,000 in bonds for the installation of an electric light plant and waterworks system in Crook. Plans are being prepared by the Henningson Engineering Company, National Bank Building, Omaha, Neb.

Canada

SYDNEY MINES, N. S.—Arrangements have been made by the Town Council for the installation of an electric light plant in Sydney Mines, to cost about $100,000.

COBOURG, ONT.—The residents of Hamilton Township are trying to secure an extension of the transmission line of the Ontario Hydro-Electric Power Commission from Cobourg to Bewdley, Cold Springs and Gore's Landing.

NORWOOD, ONT.—The Town Council has decided to secure power from the Hydro-Electric Power Commission.

ORILLIA, ONT.—Bids will be received by the Department of Public Works, Toronto Building, until March 31 for construction of power house and hospital on Main Street, to cost about $40,000 and $25,000 respectively.

PETERBORO, ONT.—Plans are under consideration by the City Council for the erection of a new hydroelectric transmission line from Healy's Falls, which will furnish electrical service in the municipalities of Havelock, Belmont, Norwood, Hastings, Keene and Westwood. The proposed line, if erected, will provide Peterboro with an auxiliary source of power.

QUEBEC, QUE.—Bids, it is reported, will soon be received by the Valcartier Lumber & Pulp Company for the erection of a pulp mill, to cost about $350,000.

SHAWINIGAN FALLS, QUE.—Plans are being prepared by D. J. Spence, architect, 246 Beaver Hall Avenue, for the construction of a community building on Transmission Avenue for the Shawinigan Water & Power Company, to cost about $150,000.

THREE RIVERS, QUE.—The North Shore Power Company, Power Building, is contemplating the installation of an electric lighting system, to cost about $10,000. W. B. Baptist is manager.

CABRI, SASK.—The installation of an electric light system in Cabri is under consideration by the Town Council.

HAWARDEN, SASK.—The installation of a municipal electric light plant in Hawarden is under consideration by the Town Council.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 25, under circular 1262, for furnishing wire rope, copper wire, lead wire, brass wire, ball bearings, indicators, connectors, condulets, etc. Further information may be obtained at the above office.

Record of Electrical Patents

Notes on United States Patents

(Issued Jan. 14, 1919)

1,291,587. TWO-WIRE PARTY-LINE LOCK-OUT TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Jan. 3, 1911. Subscriber can operate automatic switches or signals.

1,291,596. BATTERY; Herbert D. Morris, Chadds Fort, Pa. App. filed July 19, 1918. Cells protected from injurious outside influences.

1,291,597. ELECTRIC REGULATOR; Morris Moskowitz, New York, N. Y. App. filed May 22, 1909. Quickly responds to changes in circuit conditions.

1,291,598. SYSTEM OF ELECTRIC REGULATION; Morris Moskowitz, New York, N. Y. App. filed March 25, 1909. Used with constant-current generator for car lighting from axle.

1,291,601. METHOD OF ELECTRIC WELDING; Thomas E. Murray, New York, N. Y. App. filed March 28, 1918. For coupling end to end metal pipes, rods, etc.

1,291,641. RADIO COMMUNICATION; Harold P. Donle, Meriden, Conn. App. filed March 23, 1918. Electron valve for radio use.

1,291,651. ELECTRIC SWITCH; Ragnar O. W. Lundin, New Britain, Conn. App. filed Oct. 15, 1917. Push-button type.

1,291,660. PROCESS FOR PRODUCING REACTIONS IN GASES AT HIGH TEMPERATURES AND APPARATUS FOR PRACTICING THE SAME; Leland L. Summers, Chicago, Ill. App. filed July 31, 1913. Electric arc used.

1,291,667. ELECTRICAL SWITCH; Albert P. Ball, Royal Oak. App. filed June 24, 1916. Movably mounted switch contacts automatically and quickly thrown from starting to running position.

1,291,680. ELECTROLYTIC PRODUCTION OF PERMANGANATES; Benjamin F. Lovelace, Charles E. Lanning and William Judefind, Baltimore, Md. App. filed Jan. 21, 1918. Anode containing manganese and silicon employed.

1,291,681. ELECTROLYTIC PRODUCTION OF PERMANGANATES; Benjamin F. Lovelace, Charles E. Lanning and William L. Judefind, Baltimore, Md. App. filed Jan. 21, 1918. Anode contains manganese and molybdenum.

1,291,682. ELECTROLYTIC PRODUCTION OF PERMANGANATES; Benjamin F. Lovelace, Charles E. Lanning and William L. Judefind, Baltimore, Md. App. filed Jan. 21, 1918. Anode contains manganese and tungsten utilized.

1,291,697. TELEGRAPH REPEATER; Sylvester Voorhies, Enderlin, N. D. App. filed July 2, 1917. For working in main line or with main and duplex line.

(Issued Jan. 21, 1919)

1,291,699. METAL CONDUIT FOR ELECTRIC WIRES; Chauncey W. Abbott, Pittsburgh, Pa. App. filed Aug. 18, 1915. For exposed wiring in building interiors.

1,291,701. ELECTRIC CEILING FIXTURE; Harry C. Adam, St. Louis, Mo. App. filed May 16, 1918. Supporting means connected to ceiling outlet box without causing box to become unduly heated.

1,291,702. PHOTOGRAPHIC PHONOGRAPH; Frank W. Adsit, St. Paul, Minn. App. filed Dec. 4, 1916. Graphic representations of sound waves registered on film.

1,291,707. ELECTRICALLY OPERATED RELEASING DEVICE FOR WEIGHING MACHINE; Charles H. Allen, Pittsburgh, Pa. App. filed Feb. 19, 1918.

1,291,708. COMBINATION BOILER; Swen G. M. Anderson, Chicago, Ill. App. filed Oct. 20, 1917. Either for hot-water heating or steam generating.

1,291,710. FLASHLAMP; John J. P. Arter, Greet, Eng. App. filed July 6, 1918. Miniature semi-transparent maps inserted between light and magnifying lens.

1,291,713. SEPARABLE-PART INSULATOR; Arthur O. Austin, Barberton, Ohio. App. filed May 29, 1916. Threaded sleeves or shields separately secured to each insulator part.

1,291,722. LOCK SWITCH; Lionel F. Barnes, Aldershot, Eng. App. filed July 27, 1915. For ignition circuits of motor vehicles, etc.

1,291,723. VALVE; Harry W. Barrows, Omaha, Neb. App. filed June 19, 1917. Particularly for vacuum-brake systems of automobiles.

1,291,751. PROCESS FOR MAKING ALKALINE PERMANGANATES, CHLORATES AND HYDROGEN; Theodore J. Brewster, New York, N. Y. App. filed Oct. 17, 1917. Cheap raw materials used.

1,291,766. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed April 24, 1917. Signaling means for central-energy-type systems.

1,291,793. PROJECTOR; Frank H. Doyle and John Wallace, San Francisco, Cal. App. filed Nov. 1, 1915. Simple, compact, safe and easily operable.

1,291,819. ELECTRIC MOTOR; Martin Fogel and Alexander Ascher, New York, N. Y. App. filed Aug. 3, 1915. Electric engine type.

1,291,830. ELECTROPLATING APPARATUS; Joseph Giuliana, Newark, N. J. App. filed Nov. 1, 1917. Readily manipulated by one man.

1,291,831. ELECTROMAGNET; Omer M. Glunt, Rutherford, N. J. App. filed June 22, 1917. Adjustment of armature to pole pieces, easily obtained, remains permanent in service.

1,291,842. THERMOSTATIC CIRCUIT CLOSER; Abilio M. de Silva Greaves, Cambridge, Mass. App. filed May 19, 1917. Used with fire-alarm systems.

1,291,858. SIGNALING DEVICE; Troy E. Hanna, St. Louis, Mo. App. filed Sept. 3, 1918. For gas-engine lubricating systems.

1,291,863. RECORDING APPARATUS FOR USE IN CONNECTION WITH ADVERTISING DEVICES AND THE LIKE; Henry K. Harris, Westminster, London, Eng. App. filed June 7, 1915. Affords check upon operator of electrically lighted bulletin signs.

1,291,894. REGISTERING SYSTEM; Henry Hovland, East Orange, N. J. App. filed April 26, 1917. For telephone systems.

1,291,911. TELEPHONE TRANSMITTER; Arthur R. Kahl, Withington, Manchester, Eng. App. filed March 20, 1916. Main diaphragm shaped and mounted to improve purity of tone.

1,291,933. ELECTRICAL CIRCUIT-CLOSING CONTACT; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Feb. 21, 1918. Resilient pressure of coöperating contacts maintained against each other.

1,291,942. VIBRATORY CONVERTER; Oscar M. Leich, Genoa, Ill. App. filed Sept. 28, 1915. Twin vibrators and ordinary style of transformer used.

1,291,944. LIGHT-CIRCUIT CONTROLLER FOR AUTOMOBILES; Alfred A. Leopold, Pambrum, Saskatchewan, Canada. App. filed Feb. 18, 1918. Roadway sufficiently lighted when engine runs at low speed.

1,291,950. AUTOMATIC TELEPHONE REPEATER; William A. Long, Sioux City, Iowa. App. filed June 27, 1912. Three-wire to two-wire type.

1,291,959. FINDER-STARTING SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Sept. 11, 1916. Used with telephone-exchange systems.

1,291,960. NUMBER-INDICATING SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Sept. 22, 1916. For telephone-exchange systems employing machine switching.

1,291,978. AUTOMATIC SWITCH; James L. McQuarrie, Montclair, N. J. App. filed April 27, 1918. For telephone-exchange system employing machine switching.

1,291,990. TWO-WIRE ROTARY-CONNECTOR TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Oct. 11, 1909. Rotary connector is controllable over line circuit.

1,292,003. ELECTROMAGNETIC DEVICE; Daniel D. Miller, New York, N. Y. App. filed May 25, 1917. Slow-operating without use of delicate spring adjustment.

1,292,024. ELECTROLYTIC CELL; Elmer E. Niswonger, Dayton, Ohio. App. filed Sept. 28, 1918. Shunt currents reduced to minimum.

1,292,028. DIRECTION INDICATOR; Lee A. Ownbey and Arthur A. Ownbey, Chattanooga, Tenn. App. filed July 16, 1917. For automobiles.

1,292,030. CIRCUIT CLOSER FOR ALARM CIRCUITS; Anthony J. Parissi, Cohoes, N. Y. App. filed May 10, 1918. Foot-operated.

1,292,037. METHOD OF WELDING; Carl Pfanstiehl, Highland Park, Ill. App. filed Dec. 17, 1917. High-speed steel united to low-speed steel by this method.

1,292,048. ISOCHRONIZING AND SYNCHRONIZING SYSTEM; Paul M. Rainey, West Hoboken, N. J. App. filed Nov. 4, 1916. Employed in multiplex printing telegraphy.

1,292,049. TELEGRAPH SYSTEM; Paul M. Rainey, Glen Ridge, N. J. App. filed Nov. 15, 1917. Speed of mechanism at one end of line controlled by line impulses.

1,292,081. ELECTRIC SWITCH; Joseph Sachs, Hartford, Conn. App. filed Dec. 19, 1916. Locked in one of its positions when box is sealed.

1,292,094. PORTABLE ELECTRIC HEATER; Carl Schoonmaker, New York, N. Y. App. filed Feb. 20, 1918. Shaped like bulb and readily attached to light socket.

1,292,110. ELECTRIC STARTER FOR AUTOMOBILES; Norman R. Simpson, Elizabeth City, N. C. App. filed Dec. 22, 1916. After engine is running, motor recharges battery used in starting engine.

1,292,122. ELECTRIC TIME SWITCH; Eugene Steiger, Zurich, Switzerland. App. filed April 22, 1916. Operates promptly whenever atmospheric light conditions render lighting or putting out lamps advisable.

1,292,123. ELECTRIC DEVICE FOR AUTOMATICALLY TURNING LIGHTS ON AND OFF; Eugene Steiger, Zurich, Switzerland. App. filed June 17, 1916. Uses large current but guards against an overloading of selenium cell.

1,292,140. PUSH-BUTTON SWITCH; Alexander K. Sutherland, Plainville, Conn. App. filed Feb. 23, 1915. Mechanism actuated with minimum of friction.

1,292,193. REVERSIBLE MAGNETO; Porter A. Wiley, Kokomo, Ind. App. filed Jan. 19, 1916. Change in motion made without alteration of parts.

1,292,206. MAGNET CORE; John C. Woodruff, New York, N. Y. App. filed May 26, 1916. For loading coils and other electrical apparatus.

1,292,207. BUZZER; James A. Wotton, Montclair, N. J. App. filed Dec. 10, 1915. Simple in construction, easy to maintain in adjustment and efficient in operation.

1,292,208. TRANSMISSION SYSTEM; Archibald Wray, Park Ridge, Ill. App. filed Oct. 2, 1915. Relates to train-dispatching circuits that connect train dispatchers' offices with various stations.

1,292,218. ELECTRIC CHANGE-SPEED GEARING FOR AUTOMOBILES; Thorstein von Zweigbergk, Lancaster, Eng. App. filed June 21, 1916. Eliminates necessity of controller having separable contacts.

1,292,238. DUPLEX CATENARY PULL-OVER; Glenn H. Bolus, Mansfield, Ohio. App. filed March 13, 1916. Two wires gripped in fixed relation and held to each other by single pull-over device.

1,292,241. IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES; William C. Brinton, Jr., Kennett Square, Pa. App. filed March 23, 1916. To insure absolutely simultaneous production of sparks.

1,292,247. CONNECTOR AND TERMINAL FOR STORAGE BATTERIES; Herbert C. Busch, Jackson, Mich. App. filed Feb. 27, 1918. Secured or released without the aid of a wrench.

1,292,254. ELECTRIC BATTERY; Newcomb K. Chaney, Lakewood, Ohio. App. filed June 7, 1916. Dry-cell mixture free from ferrous sulphides but containing carbon and an electrolyte of ammonium and zinc chloride.

1,292,257. MULTI-OFFICE TELEPHONE-EXCHANGE SYSTEM; Edgar H. Clark, New York, N. Y. App. filed April 9, 1917. Final connecting operator informed of number of wanted line by automatically operated indicating device.

1,292,277. SWAGING MACHINE; Thomas A. Edison, West Orange, N. J. App. filed June 29, 1917. For fastening article such as diamond splint within holder or mounting.

1,292,279. CURRENT DETECTOR; Carl W. Eisenmann, Nebraska City, Neb. App. filed Aug. 3, 1916. Operates when brought adjacent to single conductor even though current flow is relatively small.

1,292,296. MAGNETO; Earl C. Freese, Marietta, Ohio. App. filed Feb. 12, 1917. Foreign matter prevented from coming in between contact members and from breaking connection.

1,292,315. SYNCHRONIZER; Frank Heath, National City, Cal. App. filed June 15, 1915. Synchronizes two or more motors of any class whether close together or separated at considerable distance.

1,292,334. FLUID-FLOW INDICATOR; Louis Larsen, Brooklyn, N. Y. App. filed Jan. 12, 1916. May be used in water-sprinkler system.

1,292,335. ELECTRIC HEATING AND LIGHTING APPARATUS; Richard G. Ledig, Robert C. Ledig and Nikolaus Gerson, Philadelphia, Pa. App. filed March 5, 1918. For therapeutic, lighting, heating and other purposes.

1,292,381. ELECTRIC CONTROLLER; Frank W. Smith, Westfield, N. J. App. filed July 27, 1916. Particularly adapted to effect the successive circuit connections of an alternating-current motor started with an inductive resistance.

1,292,386. MANUFACTURE OF CALCIUM CARBIDE; Frederick M. Becket, Niagara Falls, N. Y. App. filed April 10, 1916. Processes and apparatus provided to prepare charge for reduction in electric furnace.

1,292,387. MANUFACTURE OF CALCIUM CARBIDE; Frederick M. Becket, Niagara Falls, N. Y. App. filed April 10, 1916. See above patent.

1,292,397. ELECTRIC ARC WELDING SYSTEM; Johannes Kjekstad, Brooklyn, N. Y. App. filed Oct. 19, 1918. Energy at arc kept constant within certain limits.

1,292,402. COMBINED CURLING-IRON AND WATER-BOTTLE HEATER; Herbert W. Christian, Detroit, Mich. App. filed Feb. 12, 1918. Same heating unit used for both appliances.

1,292,403. RHEOSTAT; Herbert W. Christian, Detroit, Mich. App. filed June 17, 1918. For combined curling-iron and hot-water-bottle heater.

1,292,428. COUPLING FOR ELECTRIC TRAIN-LINE CIRCUITS; Thomas R. Brown, Sparkill, N. Y. App. filed April 4, 1917. Simple and inexpensive construction.

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1,292,431. HUMIDIFIER; William L. Cass, Manchester, Iowa. App. filed March 8, 1918. Heating means have specially formed electrodes within boiler of device.

1,292,438. ADJUSTABLE ELECTRODE FOR ELECTRIC RIVETING MACHINE; George A. Cutter, Dedham, Mass. App. filed June 21, 1918. Die brought into exact vertical line with part of work to be operated on.

1,292,451. LINE-WIRE INSULATOR; Louis Fort, Jersey City, N. J. App. filed April 13, 1915. Clamping device carries horizontal or vertical wires.

1,292,460. COMPOUND MAGNET; William A. Hansen, Princeton, Ind. App. filed Nov. 19, 1917. Electromagnet coupled to permanent magnet.

1,292,465. AUTOMATIC TELEPHONE SYSTEM; Harry E. Hershey, White Water, Kan. App. filed Nov. 28, 1913. Simplified mechanism completes connection to called line.

1,292,482. ELECTRIC LAMP; Frederick G. Keyes, East Orange, N. J. App. filed Feb. 11, 1914. Alkaline earth metals or alkali metals absorb minute traces of water vapor and oxygen.

1,292,496. ELECTRICAL MEASURING INSTRUMENT; Henry H. Lyon, Buffalo, N. Y. App. filed Dec. 1, 1916. Recording watt-meter and volt-ampere meter.

1,292,499. AUTOMATIC TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Feb. 12, 1917. Inexpensive ringing system for small exchanges.

1,292,522. SEMI-AUTOMATIC TELEPHONE SYSTEM; Michael Schwartz, Los Angeles, Cal. App. filed Nov. 10, 1913. Relates to private-branch exchange systems.

1,292,523. ELECTRIC BELL; Carl J. Schwarze, Adrian, Mich. App. filed Sept. 1, 1917. Striker bar returns to normal by means of gravity.

1,292,551. METHOD OF WINDING DYNAMO-ELECTRIC-MACHINE ARMATURES; Charles E. Wilson, Wilkinsburg, Pa. App. filed Feb. 17, 1915. Particularly insures symmetrical distribution at ends of machine-wound armatures.

1,292,571. ELECTRICAL MEASURING INSTRUMENT; Charles B. Berst, Erie, Pa. App. filed March 2, 1917. Current supplied to rotating-element meter by means of mercury and not the ordinary form of brushes.

1,292,578. DISTRIBUTING SYSTEM; Alexander Chernyshoff, Swissvale, Pa. App. filed April 1, 1915. Means for minimizing inductive interference of parallel circuits.

1,292,584. SYSTEM OF ELECTRICAL TRANSMISSION AND DISTRIBUTION; Leslie N. Crichton, Salt Lake City, Utah. App. filed Dec. 13, 1912. Accidental interruptions to service prevented on high-tension networks.

1,292,585. PROTECTIVE RELAY; Leslie N. Crichton, Salt Lake City, Utah. App. filed Dec. 13, 1912. For sectionalizing electrical transmission and distribution systems consisting of complicated networks and loops.

1,292,590. COMMUTATOR CYLINDER FOR DYNAMO-ELECTRIC MACHINES; George M. Eaton, Pittsburgh, Pa. App. filed Jan. 5, 1917. High-voltage; comparatively small type.

1,292,592. DYNAMO-ELECTRIC MACHINE; Ralph E. Ferris, Swissvale, Pa. App. filed Sept. 9, 1915. Multi-armature driving motor of bi-polar type adapted for high-voltage direct-current railway systems.

1,292,598. ELECTRIC SWITCH; Monroe Guett, Hartford, Conn. App. filed June 29, 1917. Means for electrically connecting switch contacts with terminal plates.

1,292,599. CONTROL SYSTEM; Arthur J. Hall, Wilkinsburg, Pa. App. filed Oct. 27, 1915. Step-by-step movements of controller drum by means effected dependent upon current in motor circuit.

1,292,602. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Sept. 9, 1915. Phase-advancing means for effecting power-factor compensations in polyphase induction motors.

1,292,605. CIRCUIT CONTROLLER; Albert J. Horton, White Plains, N. Y. App. filed Feb. 8, 1916. Readily tripped and manually or automatically reset.

1,292,621. FIELD MAGNET FOR DYNAMO-ELECTRIC MACHINES; Frederick W. McCloskey, Pittsburgh, Pa. App. filed Nov. 7, 1916. Double-face pole piece constructed so that form-wound coil can be used.

1,292,644. CURRENT INTERRUPTER; Benjamin K. Read, Detroit, Mich. App. filed June 26, 1916. Strong and easily kept in order.

1,292,650. ELECTROMAGNET; Charles H. Rippl, Cleveland, Ohio. App. filed June 20, 1917. Time period of opening caused by presence of lubricating oil made negligibly small.

1,292,651. PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; Charles H. Rippl, Cleveland, Ohio. App. filed July 6, 1917. Plurality of protective control-circuit contacts act in common upon single set of contacts.

1,292,656. CONTROL SYSTEM; Karl A. Simmon, Edgewood Park, and Hurd T. Morris, Wilkinsburg, Pa. App. filed Nov. 5, 1915. Embodies means for establishing loop circuit to include driving motors under predetermined operating conditions.

1,292,657. VAPORIZER; Arthur Simon, Milwaukee, Wis., and Edison O. Sessions, Chicago, Ill. App. filed Sept. 17, 1914. Heat applied directly to small quantity of fluid to be vaporized without heating entire fluid.

1,292,659. CONDUCTOR; James B. Speed, New York, N. Y. App. filed May 11, 1918. For high-frequency alternating or pulsating currents.

1,292,660. BRUSH HOLDER; Charles W. Starker, Pittsburgh, Pa. App. filed Jan. 23, 1915. Formed entirely from punched pieces of sheet metal.

1,292,682. BOX FOR ELECTRIC METERS; John V. Becka, Cleveland, Ohio. App. filed Oct. 27, 1917. Meter may be read from exterior of building while switch within housing may be operated from interior of building.

1,292,669. PORCELAIN SOCKET; John Weber, Schenectady, N. Y. App. filed Oct. 27, 1914. Casing of rigid insulating material interchangeably receives essential elements of various sockets.

1,292,708. SPEED CONTROLLER; Thomas E. Clark, Detroit, Mich., and Mark H. Hovey, Madison, Wis. App. filed Dec. 22, 1916. Adjustable device indicates highest selected speed at which vehicle may travel and causes application of air brakes when speed is exceeded.

1,292,714. ELECTRIC MOTOR SWITCH; Joel R. Cook, Cleveland, Ohio. App. filed Aug. 9, 1917. Manufactured from sheet metal by punching and stamping.

1,292,716. FLEXIBLE CONNECTION FOR ELECTRIC FURNACES; George E. Cox, Niagara Falls, N. Y. App. filed Sept. 10, 1918. Individual cables maintained in proper position.

1,292,730. DEVICE FOR CONTROLLING ELECTRIC CURRENT; Earle H. Duke and James D. Brown, Houston, Tex. App. filed March 8, 1917. For automobile lights.

1,292,759. VAPORIZER; Francis Granger, Greensburg, Pa. App. filed Dec. 5, 1914. Agreeable, healthful and germ-destroying vapors may be disseminated.

1,292,764. DRY CELL AND ITS METHOD OF MANUFACTURE; Carl Hambuechen, Belleville, Ill. App. filed April 27, 1916. Gelatinizable electrolyte contains zinc and ammonium chlorides and cereal.

1,292,765. INDICATOR FOR VEHICLES; Cameron G. Hamilton, Seattle, Wash. App. filed Oct. 23, 1916. Used day or night.

1,292,768. CONTROL APPARATUS; Frederic A. H. Harle, Paris, France. App. filed June 11, 1914. Rapidity and accuracy of action combined.

1,292,777. ELECTRIC CONTROLLER; Morris P. Holmes, Claremont, N. H. App. filed May 11, 1914. Applicable to mining machines.

1,292,800. ELECTRIC WELDING; Otis A. Kenyon, New York, N. Y. App. filed Aug. 7, 1918. Constant-potential constant-current system.

1,292,805. SELF-LOCKING SAFETY DEVICE; Hubert F. Krantz, Brooklyn, N. Y. App. filed July 31, 1915. Unskilled user barred from access to switch blades and contacts.

1,292,806. REMOVABLE SAFETY SWITCH; Hubert F. Krantz, Brooklyn, N. Y. App. filed July 31, 1915. Switch blades and immediate operating parts may be removed as units.

1,292,807. SAFETY PANEL BOX; Hubert F. Krantz, Brooklyn, N. Y. App. filed March 31, 1917. Safe and uniformly efficient even in hands of inexperienced operator.

1,292,808. SAFETY PANEL BOX; Hubert F. Krantz, Brooklyn, N. Y. App. filed March 31, 1917. Switch mechanism mounted in stationary position within casing.

1,292,809. SAFETY PANEL BOX; Hubert F. Krantz, Brooklyn, N. Y. App. filed March 31, 1917. Door locked closed whenever switch is in "on" position and switch locked in "off" position whenever door is open.

1,292,810. SAFETY PANEL BOX; Hubert F. Krantz, Brooklyn, N. Y. App. filed March 31, 1917. Similar to above patent.

1,292,812. METHOD OF UNITING METAL PARTS; Laurence S. Lachman, New York, N. Y. App. filed Feb. 8, 1918. Homogeneous welded joint.

1,292,815. VIBRATORY CONVERTER; Oscar M. Leich, Genoa, Ill. App. filed Sept. 28, 1915. Twin vibrators used in transforming alternating current into pulsating current.

1,292,827. TELEPHONE-EXCHANGE TRUNKING SYSTEM; Fritz Lubberger, Chicago, Ill. App. filed June 10, 1909. Call can be extended.

1,292,828. SEMI-AUTOMATIC TELEPHONE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Aug. 16, 1916. Connections established between manual and automatic exchanges by two-way trunking arrangement.

1,292,836. MEANS FOR MOUNTING CURRENT-DISTRIBUTER BLOCKS; Samuel C. McKeown, East Orange, N. J. App. filed Oct. 19, 1917. Holding-on means may be quickly removed so that block can be taken off ignition machine for inspection, etc.

1,292,837. MEANS FOR MOUNTING AND CONNECTING IGNITION BREAKER BOXES; Samuel C. McKeown, East Orange, N. J. App. filed Oct. 19, 1917. Means provided for adjusting box to get maximum efficiency from generator before locking it in working position.

1,292,838. IGNITION SYSTEM; Samuel C. McKeown, East Orange, N. Y. App. filed Jan. 29, 1918. Life of operating parts materially increased.

1,292,839. TELEPHONE-EXCHANGE SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed July 11, 1918. Signaling means for systems in which inter-office trunk circuits are employed for completing connections between offices.